



PHYS 2903 PHYSICS TOWARDS THE FUTURE

An on-line course based on the
Open Physics Education Module



Instructor: Kevin Graham

Email: kevin_graham@carleton.ca

Office Hours: by appointment

For questions regarding the course, please email me with the subject 'PHYS 2903'.

OVERVIEW

This course is intended for students with little or no background in Science. It introduces physics through a set of modules that are closely connected to our everyday life and future.

This course is only available on-line via Brightspace.

COURSE LEVEL LEARNING OUTCOMES

By the end of the course, students should be able to:

1. Explain physics related phenomenon using basic physics principles and terminology
2. Perform basic calculation/estimations to solve simple physics related problems
3. Make correct judgement/decisions on physics related issues in their daily lives based on basic physics principles
4. Explain our position in the solar system, our galaxy and the universe
5. Briefly describe several recent advances in physics research

TEXTBOOK

The optional textbook for the course is “Physics Beyond the Comfort Zone” by Peter Watson. This textbook has a number of relevant sections relating to material for this course, but does not cover some areas. The lectures and supplementary materials are intended to cover the course with this textbook as a useful but optional additional aid. This is an e-text book available from Amazon or iBooks for \$9.99:

https://www.amazon.ca/Physics-Outside-Comfort-Peter-Watson-ebook/dp/B01KYYX3A5O/ref=sr_1_3?s=books&ie=UTF8&qid=1472130768&sr=1-3&keywords=comfort+zone

https://itunes.apple.com/us/book/physics-beyond-comfort-zone/id902018641?mt=13&uo=4%22%20target=%22itunes_store%22%3EPhysics%20Beyond%20the%20Comfort%20Zone%20-%20Watson,%20Peter%3C/a%3E

CONTENT

The following thematic modules will be covered in this course. Each module will help you answer a series of questions listed below.

1. Sound and Music

In many ways, music might be viewed as one of the most human of inventions. What is the nature of sound and what are the relationships between pitch, loudness, musical scales and the fundamental properties of sounds? How are sounds generated, from different types of instruments, to create a musical performance?

2. Light and Colour

What is light exactly? What are electromagnetic waves? How do eyes and lenses work? How do we see colours? How do we communicate with EM waves?

3. Cell Phone

It has become commonplace, almost anywhere one travels in the world, to see people using cell phones for conversations, texting, accessing the internet, listening to music, and taking photos. What are the physics principles behind the manufacture and operation of cell phones?

4. Medical Physics

Medical physics is about using physical approaches to diagnose and treat diseases. What is an x-ray? How does it “see” through our body? What is MRI? Why do doctors prefer to order MRI instead of x-ray if you have a joint pain? How does an ultrasound scan work?

5. The Solar System and Beyond

The nature of the universe beyond our planet has always fascinated humans. How do we use rockets to place satellites in orbit and send missions out into the solar system? What is the structure of our solar system...of our galaxy...of the universe?

6. Recent Advances

Some of the most interesting questions in science are being tackled by physicists around the world. What are dark matter and dark energy? What are gravitational waves? Why is discovery of the Higgs particle important and what does it tell us? What are neutrinos and how do we observe them?

MODULE COMPLETION DATES AND PHYSICS TOPICS COVERED

Thematic Modules	Expected completion dates of lecture videos	Physics topics Covered
1. Sound and Music	Jan. 21	amplitude, velocity, wavelength, and frequency of sound waves, resonance, interference, harmonics, standing waves
2. Light and Colour	Feb. 4	radiation as wave, electromagnetic wave, optical lenses and its application, human eyes, wavelength and color, color perceptions, radio waves and communication.
3. Cell Phone	Feb. 25	semiconductors, diode and transistor, basic of logic gates and CPU, fabrication of integrated circuits, acceleration and accelerometer, rotation and gyroscope, light polarization and LCD screen.
4. Solar System and Beyond	Mar. 11	x-ray properties and production, x-ray diffraction and imaging, Ionizing radiation dose, radiation therapy, linear accelerators, accurate delivery of radiation, nuclear magnetic resonance, magnetic resonance imaging principle and safety, ultrasound and its production, reflection of US, B-mode US imaging.
5. Medical Physics	Mar. 25	gravity, momentum, energy, circular motion, orbits, time dilation
6. Recent Advances	April 8	neutrinos, Higgs particle, gravitational waves, dark energy and dark matter

EVALUATION

1. (40%) Module quizzes

At the end of each thematic module, there will be an online quiz of 15 multi-choice questions. *It is strongly recommended that the quizzes be completed some days before the deadline to avoid difficulties associated with technical issues.*

Thematic Module	Module quiz due date
1. Sound and Music	Jan. 24, 23:59 pm
2. Light and Colour	Feb. 7, 23:59 pm
3. Cell Phone	Feb. 28, 23:59 pm
4. Solar System and Beyond	Mar. 14, 23:59 pm
5. Medical Physics	Mar. 28, 23:59 pm
6. Recent Advances	Apr. 11, 23:59 pm

2. (40%) Two writing projects

Each thematic module has suggested essay topics and/or a lab you can perform using materials or devices that are easily available. **You are required to write one essay and one lab report on two of the five topics of your choice.** The lab must be chosen from the first two thematic Modules (Sound and Music or Light and Colour). The essay must be chosen from one of the four modules (Cell Phone, Medical Physics, Solar System and Beyond, or Recent Advances).

The due dates are listed in this table:

	Thematic Modules	Module essay or lab report due dates
Lab Must pick one of the two topics	1. Sound and Music	The Lab report is due on Feb 28, 23:59pm
	2. Light and Colour	
Essay Must pick one of the four topics	3. Cell Phone	The Essay is due on April 11, 23:59pm
	4. Medical Physics	
	5. Solar System and Beyond	
	6. Recent Advances	

For the lab report, a write-up template is provided. The essay must be **800-1000 words**. Both the essay and lab reports must be written using word processing software. **Hand written essays will NOT be accepted and will be given zero mark.** Essays or lab reports should be uploaded via CULearn before the deadline given above.

3. (20%) Final online exam

During the final exam period, there will be an online final exam of multiple-choice questions that cover all the content of the course.

Special Information Regarding COVID-19

All members of the Carleton community are required to follow COVID-19 prevention measures and all mandatory public health requirements (e.g., wearing a mask, physical distancing, hand hygiene, respiratory and cough etiquette) and mandatory self-screening prior to coming to campus daily.

If you feel ill or exhibit COVID-19 symptoms while on campus or in class, please leave campus immediately, self-isolate, and complete the mandatory symptom reporting tool. For purposes of contact tracing, attendance will be taken in all classes and labs. Participants can check in using posted QR codes through the cuScreen platform where provided. Students who do not have a smartphone will be required to complete a paper process as indicated on the COVID-19 website.

All members of the Carleton community are required to follow guidelines regarding safe movement and seating on campus (e.g., directional arrows, designated entrances and exits, designated seats that maintain physical distancing). In order to avoid congestion, allow all previous occupants to fully vacate a classroom before entering. No food or drinks are permitted in any classrooms or labs.

For the most recent information about Carleton's COVID-19 response and required measures, please see the University's COVID-19 webpage and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.

Please note that failure to comply with University policies and mandatory public health requirements, and endangering the safety of others are considered misconduct under the Student Rights and Responsibilities Policy. Failure to comply with Carleton's COVID-19 procedures may lead to supplementary action involving Campus Safety and/or Student Affairs.

Note About COVID-19 & Mental Health

The global pandemic has led to extra stress and uncertainty for everyone. Remember that Carleton has available an array of mental health and well-being resources, which can be found [here](#).

University Policies

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52
F = <50			

WDN = Withdrawn from the course

ABS = Student absent from final exam

DEF = Deferred

FND = (Failed, no Deferred) = student could not pass even with 100% on final exam

Academic Accommodations, Regulations, Plagiarism, Etc.

Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University. More information can be found at:

<https://students.carleton.ca/course-outline/>

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here:

<https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/>

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the [Paul Menton Centre website](#).

Addressing Human Rights Concerns

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca.

Religious Obligations

Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (PDF, 2.1 MB).

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <https://carleton.ca/sexual-violence-support/>

Accommodations for Missed Work

Carleton recognizes that these are unprecedented times during the COVID-19 pandemic, and that students may be experiencing greater stress and other life factors that are not in their control. As a result, Carleton has put into place a protocol for students to apply for accommodations using a self-declaration form in the event of missed work. The form can be found at: <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>

For Pregnancy

Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (PDF, 2.1 MB).

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the [Senate Policy on Accommodation for Student Activities \(PDF, 25KB\)](#).

Academic Integrity

Academic misconduct undermines the values of honesty, trust, respect, fairness, and responsibility that we expect in this class. Carleton University provides supports such as academic integrity workshops to ensure, as far as possible, that all students understand the norms and standards of academic integrity that we expect you to uphold. Your teaching team has a responsibility to ensure that their application of the Academic Integrity Policy upholds the university's collective commitments to fairness, equity, and integrity. (adapted from Carleton University's Academic Integrity Policy, 2021).

Examples of actions that do not adhere to Carleton's Academic Integrity Policy include:

- Plagiarism
- Accessing unauthorized sites for assignments or tests
- Unauthorized collaboration on assignment and exams

Sanctions for not abiding by Carleton's Academic Integrity Policy

A student who has not adhered to Carleton's Academic Integrity Policy may be subject to one of several sanctions:

1. If you take full responsibility for your actions, and it is the first time you have violated the policy, you will receive zero on the assessment. If you are found to have violated the policy but do not take responsibility, an additional grade deduction will be applied (e.g. an A- will become a B+)
2. Subsequent violations of the policy may result in more severe sanctions such as failing the course, suspension from all studies and/or expulsion.

Process of an Academic Misconduct Investigation

Step 1: The instructor believes misconduct has occurred and submits documentation to the Dean of the Faculty of Science.

- Step 2:** The Dean reviews documentation and can proceed with or dismiss the allegation.
- Step 3:** If sufficient evidence, the student receives an allegation statement by email. Ombuds services is copied on the email.
- Step 4:** The student provides a written response to the evidence provided.
- Step 5:** Either party may request a meeting between student, dean, and the ombudsperson.
- Step 6:** Dean informs the student of the decision.
- Appeal:** Student has the right to appeal the decision.

Additional details about this process can be found on [the Faculty of Science Academic Integrity website](#). Students are expected to familiarize themselves with and follow the [Carleton University Student Academic Integrity Policy](#). The Policy is strictly enforced and is binding on all students.

Plagiarism

Plagiarism is the passing off of someone else's work as your own and is a serious academic offence. For the details of what constitutes plagiarism, refer [the Faculty of Science Academic Integrity website](#). To further understand Academic Integrity, consider attending the [Learning and Support Academic Integrity Workshop](#).

What are the Penalties for Plagiarism?

A student found to have plagiarized an assignment may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; award of an FNS, Fail, or an ABS.

What are the Procedures?

3. All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.
4. The Dean writes to the student and the University Ombudsperson about the alleged plagiarism.
5. The Dean reviews the allegation. If it is not resolved at this level then it is referred to a tribunal appointed by the Senate.

Students are expected to familiarize themselves with and follow the [Carleton University Student Academic Integrity Policy](#). The Policy is strictly enforced and is binding on all students.

Assistance for Students

Academic and Career Development Services: <http://carleton.ca/sacds/>

Writing Services: <http://www.carleton.ca/csas/writing-services/>

Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/group-support/pass/>

Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>

Science Student Success Centre: <https://sssc.carleton.ca/>