

Modern Physics II (PHYS 3606-3608) Course Outline-Winter 2021

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Teaching Assistant	<i>Jerome Claude</i> (jeromeclaud@carleton.ca)
Office Hours	Wednesday 1:00 - 2:00 pm: https://carleton-ca.zoom.us/j/98396549641 Friday 1:00 - 2:00 pm: https://carleton-ca.zoom.us/j/95406230201 Outside office hours please contact me via email.
Lectures	Wednesday-Friday 11:35 am to 12:55 pm. Zoom meeting coordinates: 1) Wednesday Lecture: https://carleton-ca.zoom.us/j/91728456605 2) Friday Lecture: https://carleton-ca.zoom.us/j/97532276175
Labs	<u>Instructor</u> : Penka Matanska (matanska@physics.carleton.ca) Session A1: Friday 8:35 am to 10:25 am Session A2: Friday 2:35 pm to 4:25 pm Session A3: Thursday 2:35 pm to 4:25 pm Labs begin on January 14 for session A3, January 15 for sessions A1 and A2. You will be asked to keep an electronic log to demonstrate your work to set up the experiment, make the measurement and analyze the collected data. The lab policy will be reviewed in the first lab period. Lab home kits will be shipped to students early in January 2021. Students will be contacted by the lab instructor and received detailed information about the home kit delivery in December 2021.
Text	There is no assigned textbook for the course. Lecture notes will be posted on cuLearn in advance of the lecture. Students are expected to attend the lectures and take notes. For further study a list of recommended books is given later in the course outline.
WebSite	cuLearn PHYS 3606 and PHYS 3608 sites
Prerequisites	PHYS 2604 and PHYS 3701 or permission by the department
Marks	Assignments 15% Laboratory 45% Final Exam 40% In order to pass the course each one of your theory and laboratory grades must be above 50%.

Course Description

In this course we will examine a variety of physics phenomena and we will interpret them through the application of the fundamental laws of non-relativistic quantum mechanics. Most of the topics that will be covered in this course form the basis of a number of sciences such as chemistry, biology and geology and of every aspect of modern engineering as a discipline. For each topic two lectures on average will be dedicated which will correspond to about one week for each. The following topics will be covered:

Atomic Physics

1. The Hydrogen Atom (with a brief introduction to the Polynomial Method)
2. The Periodic Table of Elements
3. Atoms in Magnetic Fields-Nuclear Magnetic Resonance (NMR)
4. The Hydrogen Atom in a Magnetic Field-The Zeeman Effect

Molecular Physics

1. The Chemical Bond I-The Amazing Properties of the Water Molecule
2. The Chemical Bond II-The Cycle of Light

Solid State Physics

1. Theory of the Energy Bands: Conductors, Semiconductors, Insulators

Cosmology

1. Fermi Energy: Gravitational Collapse-The Life of a Star

Light & Matter

1. Interaction of Light with Matter: Stimulated Transitions-Lasers
2. Interaction of Light and Matter: Scattering-The Color of the Sky

Nuclear Physics

1. Hyperfine Structure-The Most Important Line in the Universe
2. From Discrete to Continuous: The Alpha Decay and the Age of the Earth
3. α, β, γ : Nuclear Transmutations, the Sun and the Best Energy Source we have

For the creation of these notes I relied heavily on the notes of old professors of mine whose student I had the privilege of being. They have strived to teach me that in the long run physics is nothing else but the application of common sense and analytical thinking. I consider this to be the most important learning objective of this course and it will be emphasized repeatedly during the term.

Assignments: There will be roughly biweekly assignments posted on cuLearn and they will generally be due two weeks after their distribution (or as announced in class). Assignments should be emailed directly to your teaching assistant. Late assignments will not be accepted without a valid reason such as severe illness. You may discuss the assignment problems with other students in this course; however, the work you turn in must be your own. Feel free to consult me when you have questions (either during office hours or by setting up an appointment). The assignments are a critical part of the course

and working through the problems yourselves is essential to absorb the material. Your solutions should be thorough, self-contained and logical, with all steps explained. If not typed, i.e. scanned, the assignments must be deemed legible by the marker.

Exams:

- The final exam will be 3 hours long, to be held during the final examination period in April.
- The final exam will be closed book. Exam formats will be discussed in advance. It is expected that all steps will be explained in detail following a logical outline presented at the beginning of the solution and justified using all knowledge gained during the course. This will account for half (50%) of each problem's final grade.

Missing Exams

If you miss the final exam, you must contact the Registrar's Office within the time period specified in the university calendar. You will need to fully document your application. Students are encouraged to review the policies of deferred exams in the university calendar. A request to write a deferred exam will be granted only if adequate term work has been demonstrated. In this context, adequate term work means completing and submitting all of the assignments and fulfilling the lab requirements as laid out in the lab policy; in addition, both of the student's assignment and lab term grades should be above 50%. The grade FND (Failure with no deferred final exam) will be assigned when the student has failed the course on the basis of inadequate term work. The grade FND is assigned 0.0 grade points.

Suggested Reading

1. Serway, Raymond A., et al. 2004, Modern Physics, 3rd edition.
Publisher: Thomson Education
https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1gorbd6/alma991014075679705153
2. Thornton & Rex 2006, Modern Physics for Scientists & Engineers, 3rd edition.
Publisher: Cengage Learning
https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1gorbd6/alma991014075719705153
3. D. J. Griffiths, 1995, Introduction to Quantum Mechanics,
Publisher: Pearson/Prentice Hall
https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1gorbd6/alma991001309299705153
4. B. L. Van Der Waerden, Editor, 1967, Sources of Quantum Mechanics, Classics of Science Vol.5
Publisher: Dover
https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1gorbd6/alma991008826689705153
5. A. C. Melissinos, 1966, Experiments in Modern Physics,
Publisher: Academic Press
https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1gorbd6/alma991008803299705153

Academic Policies

Academic Regulations, Accommodations, Plagiarism, Etc.:

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:

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

Academic Accommodations for Students with Disabilities:

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at **613-520-6608** or **pmc@carleton.ca** for a formal evaluation.

If you are already registered with the PMC, contact your PMC coordinator to send your *Letter of Accommodation* at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*).
carleton.ca/pmc

*The deadlines for contacting the Paul Menton Centre regarding accommodation for final exams for the Fall exam period is **November 8, 2019** and for the Winter exam period is **March 13, 2020**.

For Religious Obligations:

Students requesting academic accommodations on the basis of religious obligation should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory event.

Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student.

Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance.

carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

For Pregnancy:

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required.

carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

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, the potential penalties and the procedures refer to the section on Instructional Offences in the Undergraduate Calendar.

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?

All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.

The Dean writes to the student and the University Ombudsperson about the alleged plagiarism.

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 (see <https://carleton.ca/registrar/academic-integrity/>). The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

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/>

Important Information:

- Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).

- Students must always retain a hard copy of all work that is submitted.
- Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.
- Carleton University is committed to protecting the privacy of those who study or work here (currently and formerly). To that end, Carleton's Privacy Office seeks to encourage the implementation of the privacy provisions of Ontario's *Freedom of Information and Protection of Privacy Act (FIPPA)* within the university.
- In accordance with FIPPA, please ensure all communication with staff/faculty is via your Carleton email account. To get your Carleton Email you will need to activate your MyCarletonOne account through Carleton Central. Once you have activated your MyCarletonOne account, log into the MyCarleton Portal.

Important Dates

WINTER 2021

January 4, 2021	University reopens.
January 6, 2021	Winter term classes begin.
January 20, 2021	Last day for registration for winter term courses.
	Last day to change courses or sections (including auditing) for winter term courses.
January 31, 2021	Last day for withdrawal from winter term and winter portion of fall/winter courses with full fee adjustment. Withdrawals after this date will result in a permanent notation of WDN on the official transcript.
February 15, 2021	Statutory holiday. University closed.
February 16-19	Winter Break, no classes.
March 12, 2021	Last day to request Formal Examination Accommodation Forms for April examinations to the Paul Menton Centre for Students with Disabilities. Note that it may not be possible to fulfil accommodation requests received after the specified deadlines.

March 26, 2021	Last day for summative tests or examinations - or for formative and/or practical tests or examinations totaling more than 15% of the final grade - before the official examination period (see Examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar).
April 2, 2021	Statutory holiday. University closed.
April 9, 2021	Winter term ends.
	Last day of fall/winter and winter term classes.
	Last day for take-home examinations to be assigned, with the exception of those conforming to the Examinations regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar.
	Last day for academic withdrawal from fall/winter and winter term courses.
	Last day for handing in term work and the last day that can be specified by a course instructor as a due date for term work for fall/winter and winter term courses.
April 10, 2021	No classes or examinations take place.
April 11-23, 2021	Final examinations in winter term and fall/winter courses may be held. Examinations are normally held all seven days of the week.
April 23, 2021	All take-home examinations are due on this day, with the exception of those conforming to the Examinations regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar.