PHYS 1004, Summer 2020
Information and Course Outline

1. Course Description

This course is designed to introduce electricity, magnetism, circuits, electromagnetic induction, and electromagnetic waves from a physics perspective for students in engineering programs. The associated laboratory sessions will meet virtually on a weekly basis starting in the first week of the term. Student evaluations will be based on labs, online and a final exam.

This calculus-based online course introduces electricity, magnetism, oscillations, waves and optics. The laboratory is an essential and autonomous part of the course.

A credit in this course precludes additional credit for PHYS 1002, PHYS 1008 and BIT1204.

Some students believe that if they can follow the lectures, then they have learned physics. This is usually not true. Learning physics is not a spectator sport. To learn physics, a student must do work outside of lecture time thinking about, and interacting with, the course material. *No one ever learns physics by simply reading about it or listening to someone talk about it. You learn it by making the effort to understand the material and by solving problems using the principles learned.* The standard requirement in a college course is that you spend two hours outside of class for every hour of lecture. There is no substitute for spending time learning the material.

It must be said, learning physics is a very active process! Everyone one can do it with some effort. You all can do it. You will need to take the lead in this effort. Ask questions whenever you need help! Watching someone else "do physics" doesn't often do much for you! Once you realize that PHYSICS is really fun as you see it in everyday's life then you will know that you have understood it.

Please note that summer course is a very condensed (shorter time that Fall and Winter courses) and hence students must keep up with learning every day and not let go until after the final exam.

2. Course Times

Lectures

Room Online at real time

Time: Monday and Wednesday, 2:35 to 5.25 pm

Instructor:

Dr. Mustafa Bahran

Office: 3412 HP
Phone: 613-520-2600 EXT. 5094
E-mail: mustafabahran@cunet.carleton.ca

Hours: Online Friday 6:05 to 8:05 pm

Laboratory

Room: Online at real time

Time(s): **A1:** Fridays, 1:05 to 3:55pm
A2: Mondays, 8:35 to 11:25pm
A3: Tuesdays, 2:35 to 5:25pm

Supervisor:

Maria Paula Rozo Martinez

Office: HP 3304
E-mail: prmartin@physics.carleton.ca

Final Exam: Date, time and location to be confirmed

3. Course Objectives

We will become familiar with electromagnetic theories, concepts and applications surrounding:

1. Electric Phenomena
    a. Notion and applications of charges
    b. Coulomb force as a function of charge and distance
    c. Electric fields as a function of charge and their influence as the origin of the Coulomb interaction
    d. Parallel plate system as a source for a uniform E field
    e. Electric potential energy and electric potential
    f. Potential Difference and its connection to Electric fields and Work
    g. Capacitors as devices to store charge and energy
2. DC and AC Circuits
    a. Currents in a conductor under the influence of a potential difference
    b. EMF and batteries
    c. Resistors
        i. Circuits with multiple resistors – equivalent resistance
        ii. Circuits with multiple EMF's – Kirchhoff's Laws
    d. Circuits with resistors and capacitors in combinations – RC Circuits
    e. Sinusiodally varying EMF
        i. Reactance and impedance within an AC circuit
        ii. Effect on Power and current
        iii. Resonance and bandwidth
3. Magnetism
    a. Effect of B field on a moving charge
        i. Right Hand Rule
        ii. Mass Spectrometer
        iii. Velocity Selector
    b. Effect of B field on current in a wire
    c. Moving charge as the source of B fields
    d. B fields around wires
    e. Solenoids
    f. Electromagnetic Induction
4. Electromagnetic Radiation
    a. EM Spectrum and characteristics of EM waves
    b. Wave phenomena
        i. Refraction
        ii. Reflection
        iii. Polarization

Numerical solutions and critical thinking will be utilized and tested through assignments and laboratories. Direct real-world applications are highlighted in lectures, examples and reading from the textbook.

This course will rely heavily on a basic understanding of both differential and integral calculus for the theoretical development of concepts presented. Some topics of advanced calculus may be introduced, though will not be developed in any meaningful way, such as partial derivatives, line integrals and surface integrals.

Additionally, significant practice in problem solving, algebra and scientific computing will be exercised throughout the term. Formula sheets will be provided but knowledge of the meaning

and the concepts they reflect will be part of the objectives of the lectures and therefore are the student's responsibility to use in assignment and tests accordingly.

More detail on the relevant chapters from the textbook and the course of these topics within the tentative lecture schedule is given in **Section 6.**

4. How the Course is Run

4.1. Pre-requisites

Students in this course must normally have **MATH1004** and either have passed or be concurrently registered in **ECOR 1101** Mechanics I

- or else have passed PHYS 1003 Introductory Mechanics and Thermodynamics

  or PHYS 1001 Foundations of Physics I

  or PHYS 1007 Elementary University Physics I (with a grade of at least B-)

  or BIT1203 Physics for Photonics I

If you do not have both requirements you must check with your professor to obtain permission of the Physics Department to take this course. If you withdraw from ECOR 1101 during the term, you will be required to also withdraw from PHYS 1004.

4.2. Required Text

Fundamentals of Physics, Halliday, Resnick and Walker 9th, 10th or 11th E, Volume 2, Chap 21-44. J. Wiley & Sons. (Available at the Bookstore, University Centre.)

4.3. Web Page

This course will make extensive use of cuLearn to deliver Online Assignments, Course Material, Information, Tracking Grades, Suggested Problem Sets, etc. The address to start off with is

https://culearn.carleton.ca/moodle/login/index.php

Once you have logged in, your browser will load a page that has course links to any of the courses that you are enrolled in. Click on:

PHYS1004A [21328] Electromagnetism & Wave Motion (LEC) Summer 2020

If you are unable to access cuLearn or need help with your computing account, please contact the CCS Service Desk at 520-3700 or email ccs_service_desk@carleton.ca.

4.4. Labs

Labs start the week of **July 6, 2020**.

Due to COVID-19 quarantine circumstances, the labs this term will be delivered virtually through the BigBlueButton web conferencing system on CuLearn. The virtual laboratories will concentrate on data analysis techniques, stressing the statistics, uncertainties, error propagation, and results comparison on previously collected data. Although the measurement and hands-on aspect of the labs will be mostly missing, when possible, suggestions on how to perform a simplified version of the experiment at home will be provided.

Students will be required to download and use the ***Logger Pro* software** from Vernier (download and installation details will be provided through cuLearn). If a student experiences any problems or is unable to access and use Logger Pro, that student should contact and inform the Lab Coordinator in order to arrange for a different delivery of the material. It is strongly recommended to have Logger Pro installed before the Introductory session.

Attendance to **all** labs and submission of lab work (write-up and Logger Pro files) for each experiment is required as a passing condition for this course. Note that you can only attend the lab section that you are registered in. If you have a documented reason for missing a laboratory session, you must contact the Lab Coordinator **immediately**. A make-up session may be arranged in these cases. If you do not have valid justification, you will not be permitted to take a makeup session, and you will receive a mark of zero for that experiment.

For students repeating this course, you may request to be exempt from the lab (and have your lab mark carried forward from before) if you have completed all the lab experiments with an acceptable lab mark. You must contact your lab supervisor and obtain explicit permission to be exempt from the lab.

4.5. Lecture attendance

It is highly recommended that students attend every lecture (online) throughout the term and it is therefore expected that students will make every effort to do so. Lectures will contain additional information, hints and examples that may not available on the lecture slides, in the textbook or in general information provided via the course cuLearn website. If a student misses a lecture it is his or her responsibility to determine what information was presented. That is to say: **students are responsible for everything the professor delivers during lectures as well as materials in relevant chapters of the book and on cuLearn. That is in addition to the lab requirements.**

It is also expected that students will also read relevant sections in the textbook (or the equivalent) that match those presented during lectures. Due to the time constraints, it is not always possible to give the most complete description of all phenomena in the lecture. Supplemental material is found in the textbook and is therefore subject to appear on tests and assignments.

4.6. Tests and Assignments

4.6.1. cuLearn Weekly Assignments (HWs)

There will be 6 online HW assignments that will be used as part of the overall term marks. These will be administered through cuLearn and can be accessed through the Assignments section.

The assignments will be based on material studied during the lectures during that week. Each HW assignments will be available for a full week for students to solve.

Be vigilant and be sure to always check the due dates on the list. There will be an assignment scheduled on a weekly basis; the actual date and times are to be determined at the beginning of the term.

If there is any discrepancy between the marks posted in cuLearn gradebook and your calculated values notify the instructor immediately.

Questions

Before starting each assignment, first read the relevant chapter(s) in the text book. Each assignment will consist calculation-based questions for which you will be given 60 minutes to answer. You will be given 2 attempts at each assignment before the posted deadline, **no additional** attempts will be allowed following the deadline, with the highest mark of the two attempts taken as the mark for that assignment. Questions have randomized choices of input variable values, so that no two attempts are likely to repeat the same question set.

Numerical Answers

In answering the assignment calculation questions enter the answer when appropriate in **scientific notation with three significant figures e.g. 1.60E-19 for 1.6 x 10^{-19}**. You are allowed a 5% variance between your answer and the one calculated within cuLearn to account for round errors, and so on. If you do not your answer with three significant figures your answer will be outside of this 5% threshold and will therefore be marked as incorrect. Answers of this sort will not be eligible for re-assessment by the professor.

Be sure always to take careful note of the units for your answer, typically it is expected that the answer will follow SI units (m, s, J, etc.) however there are occasions in with non-standard units will be required for the specific question. Generally, these instances will be noted in the question itself, e.g. “Express your answer in km”. Also, units are **not to be entered** with the numerical answer for these assignments!

Scientific Calculators

It is highly recommended that you use and understand the functionality of a reliable scientific calculator for all calculations on assignments and tests. In particular, it is good practice to fully understand how to use the scientific notation functionality that all scientific calculators will have available. This will save a great deal of time in all your calculations and greatly reduce mistakes. There are a number of additional functions (such as tabbed results) which can be beneficial in performing calculations.

4.6.2. Pre-Class Quizzes (RQs)

In addition to the weekly online assignments through cuLearn, there will be a pre-class quiz due before each lecture. The quiz will consist of 10 multiple choice questions with a 45-minute time

limit. There will only be one attempt at these quizzes and all quizzes will count toward the final PCQ grade. The questions will be conceptually based and so in general no calculations will be needed to complete any individual question. The PCQ will generally opened 2-3 days prior to the deadline, so be diligent when checking cuLearn.

4.6.3. Final Examination

Final examination will an online exam. It will be scheduled during the regular examination period, at the end of the term. The final exam will be a cumulative covering all sections and chapters studied during the lectures.

The exam will not include material from the laboratory manual.

4.7. The Marking Scheme

The marking scheme will be as follows:

Online Assignments:	25%
Pre-Class Quizzes	15%
Final Exam:	35%
Theory section	75%
Laboratory:	25%
Total	100%

4.8. Passing Conditions

In order to pass the course, students must attempt and hand in a report for **all labs**. Missing labs must be accounted for, usually by bringing in a doctor's note, to the Lab Supervisor. There will be an assigned date at the end of the term for students to make-up labs missed due to a valid reason.

In addition, you must have

1. an overall mark must be ***greater than 50%***, AND
2. must achieve ***40% or above*** on *BOTH* the Theory (≥ 26/65) *AND* the Lab (≥ 14/35) components of the course.

(**NOTE:** Theory includes Assignments, PCQ and Final Exam)

Students with an overall course mark above 50%, but who achieve between 40% and 49% on either Theory or Lab Experiments will be given a grade of D-, no matter how good their overall mark is.

5. Additional Information

5.1. Academic Accommodations

5.1.1. 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 scheduled test or exam requiring accommodation (if applicable).

*The deadlines for contacting the Paul Menton Centre regarding accommodation for final exams for the early summer exam period is June 1st, 2018 and for the late summer exam period is July 23rd, 2018.

5.1.2. For Religious Obligations:

Students requesting academic accommodation based on 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.

5.1.3. 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.

5.2. Copying, plagiarism, and other forms of cheating

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/

In this course, these rules are relevant mainly for lab reports (do not copy someone else's), tutorial tests and the final exam (do not attempt to use unauthorized materials or collaborate with other students). A report will automatically be sent to the Dean of your Faculty, for possible further disciplinary action.

5.2.1. Plagiarism

Plagiarism is the passing off 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.

5.2.2. 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.

5.2.3. What are the Procedures?

All allegations of plagiarism are reported to the faculty of Dean of FASS and Management. 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.

5.3. Deferred Exams

Deferred Exams are generally only granted to students who cannot take the regularly scheduled exam due to illness or condition beyond there control. Students must present a doctor's note to the Science Registrar within five working days of the date of the final exam. The Deferred Exam replaces only the Final Exam portion of the marks.

In order to be eligible for a Deferred Exam you must have earned at least 8 out of the possible 25 marks on term work in the theory component of the course (i.e. the Assignments, ICQ and PCQ) and at least 14 out of the possible 35 lab marks.

5.4. Request for Documentation in Accessible Format

This document is available in a variety of accessible formats upon request. A request can be made on the Carleton University website at:

http://www.carleton.ca/accessibility/request

The course outline will be posted on the cuLearn Website. We reserve the right to amend the course outline on the cuLearn Website, and will inform you if that version changes. In the event of any discrepancy between this document, and the version currently posted on the website, then the website version will be taken as the definitive version.

5.5. Email

Every student must use their Carleton Connect account in any communication to University academic staff. Emails sent from external e-mail accounts will **not** be answered. Please do not forward your emails from Carleton connect accounts to external emails. The University will not be responsible if important communications from the University, including the course instructors and academic staff, are not delivered due to a failure in the forwarding process. *It is important to monitor the space available in your account. If a message cannot be delivered due to an overflow, then you may miss something important.*

When communicating with the lecturer or lab supervisor, please write your email in a structured, professional and coherent manner, with correct spellings and grammar, it should be treated as an official communication. It is also advisable that you include the course number (i.e. PHYS 1004) in the subject of your message to help ensure your message is not tagged as spam or junk by the email filter.

Additionally, it is possible to send emails through the cuLearn page, in which case the email will automatically be tagged as PHYS1004.

6. Lecture Schedule and Syllabus

Note this is a tentative schedule of Chapters covered by lecture (this schedule of lectures is subject to moderate changes as the semester progresses)

RQs are available at least 3 days before due time and HWs are available one week before due time.

Lecture	Topic(s)
Jul 06	Introduction Math and Physics Review Ch 21 – Coulomb's Law RQ1 is due.
Jul 08	Ch 22 – Electric Fields RQ2 is due.
Jul 13	Ch 23 – Gauss' Law HW1 is due.
Jul 15	Ch 24 – Electric Potential RQ3 is due. HW2 is due.
Jul 20	Ch 25 – Capacitance Ch 26 – Current and Resistance
Jul 22	Ch 27 – Circuits RQ4 is due. HW3 is due.
Jul 27	Ch 28 – Magnetic Fields Ch 29 – Magnetic Fields due to Currents
Jul 29	Ch 30 – Induction RQ5 is due. HW4 is due.
Jul 31	Ch 31 – Electromagnetic Oscillations and Alternating Current
Aug 03	**Civic Holiday**
Aug 05	Ch 32 – Maxwell's Equations RQ6 is due. HW5 is due.
Aug 10	Ch 33 – Electromagnetic Waves
Aug 12	Catch-up and course review

7. Lab Schedule

Lab #	Title	Weight (%)	Week of
0	Introductory Session		July 6, 2020
1	Electrostatics	20	July 13, 2020
2	DC Circuit	20	July 20, 2020
3	Oscilloscope	20	July 27, 2020
4	Magnetic Balance	20	Aug 3, 2020
5	RLC Circuits	20	Aug 10, 2020

*******Relevant documentation for each experiment will be posted on cuLearn one week prior to the scheduled lab session. A prelab quiz will be administered on cuLearn for every experiment.

8. 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.