Physics II for the Physical Sciences

PHY A21 - Winter 2019

Tuesday	4:00 pm - 6:00 pm	HW 216
Thursday	4:00 pm - 5:00 pm	SY 110

$$\left[\begin{array}{rcl} \nabla \cdot \mathbf{E} &=& 0 \\ \nabla \cdot \mathbf{B} &=& 0 \\ \nabla \times \mathbf{E} &=& -\frac{\partial \mathbf{B}}{\partial t} \\ \nabla \times \mathbf{B} &=& +\frac{\partial \mathbf{E}}{\partial t} \end{array}\right] \quad \ldots \quad \text{and there was light.}$$

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Office Hours

Wednesday	12:30 pm - 2:30 pm	5:15 pm - 6:15 pm
Thursday	9:30 am - 11:30 am	5:15 pm - 6:15 pm

What is Light?

Our first answer to this question will come from our studies of **Waves** and **Electromagnetism**. Further queries on the nature of light will take us into **Special Relativity**. By the end of the term, we will be ready for follow-up courses in **Quantum Mechanics** where various questions regarding light and associated phenomena will lead us into the fields of atomic and nuclear physics.

By the end of the course you will be able to:

- Identify and define the basic vocabulary used in the study of Wave motion and related phenomena, Electricity and Magnetism, and Special Relativity.
- Use techniques of analytical and numerical problem solving that go beyond "plug-in-the-formula".
- Interpret and give examples of the physical laws governing electric and magnetic interactions, electromagnetic waves, and relativistic phenomena.
- Recognize the important change in paradigm that led to the development Special Relativity and the beginning of what is known as Modern Physics.
- Using mathematics as the basic scientific language, employ techniques of single-variable calculus to model, simplify, and solve physical problems.
- Employ individual and group problem-solving skills to the analysis of physical systems, in the form of: experiments, conceptual and phenomenological questions, and multi-concept detailed problems.
- Recognize the existence of a basic model for the study of Physics, and translate this model into tools and learning skills useful in other disciplines.
- Develop strategies to implement the acquired organization, study, and discipline skills learned in the course to future academic and professional areas.

Course Requisites & Required Materials

Course Corequisite: Calculus II (MATA35/36/37)
Course Pre-requisites: Introduction to Physics IA (PHYA10), Calculus I (MATA30/31)

- **Textbook:** ***Physics for Scientists and Engineers*** by Randall D. Knight (Pearson, 4th Ed.)

The schedule provided at the end of this document indicates the readings you must complete **before** each lecture. The reading quizzes and in-class participation will be based on these assigned readings.

Your first time reading the assigned material does not need to be highly detailed. Focus on the main concepts, read one or two examples, and browse quickly thorough any derivations. This first reading will be the assumed starting point for all lectures. Therefore, failing to complete the readings and associated reading quizzes will impair your ability to understand our lecture discussions.

The textbook also provides the conceptual questions and detailed problems that will be the subject of the weekly online homework, practical activities, and group quizzes. Please note that you will need an access code to **MasteringPhysics**, either through a bundled textbook or bought separately from the bookstore. Follow the link labelled MyLab and Mastering on the course website to complete your registration.

- **Automated Student Response System:** ***i>clicker*** or ***i>clicker+*** by Macmillan

You will need a clicker to answer the in-class participation quizzes. To receive the participation mark you must register your clicker by **Monday, January 28** using the link labelled i>clicker registration on the course website.

Note that in order to receive this participation mark you must be present with your clicker during the lecture discussions. Having somebody else use your clicker in your place or using somebody else's clicker in their place is a serious academic offence that could have you facing expulsion from the university.

- **Calculator:**

Casio: FX-260, FX-300*
Texas Instruments: TI-30X IIS, TI-30XS
Sharp: EL-520*, EL-531*, EL-W535*

For the course, any **scientific** and **non-programmable** calculator will be required. The models listed above are some of those available at the bookstore that satisfy the course requirements. The asterisk "*" indicates that any sub-model within that specific model designation is also accepted.

Grading Scheme

Component	%	Due Date
Reading Quizzes	5	Ongoing (Pre-Lecture)
Participation	5	Ongoing (Lecture)
Online Homework	5	Ongoing (Weekly)
Practical Activities	10	Ongoing (Weekly Practicals)
Formal Lab Reports	10	Week 8 & Week 12
Test #1	10	Week 6 (Tentative)
Test #2	20	Week 10 (Tentative)
Final Examination	35	Exam Period (April 10 - 27)

Grade Components

Reading Quizzes (5%)
Before each Tuesday lecture, on MasteringPhysics, you will be asked a set of questions from the assigned textbook readings for the week. You will have until **11:55 am** on Tuesday to submit your answers. Each quiz is worth **5 points**, and your final grade is the total sum of all quizzes up to a maximum of **50 points**. Use the **Class Schedule** and quiz instructions to prepare for the lectures and reading quizzes.

Participation (5%)
During each lecture we will work on clicker questions from the textbook readings and the lecture presentation. During each lecture **1 point** can be earned by answering at least **75%** of the questions asked. The total sum of all lecture points makes up your participation grade up to a maximum of **20 points**. In addition, after each lecture one participation question will be selected for a performance bonus. An extra **1%** will be awarded to those students that correctly answer **50%** or more of the performance questions.

Online Homework (5%)
These will be a weekly set of questions posted on MasteringPhysics. The questions will be based on the previous week's textbook reading material and lecture discussions. Each homework is worth **10 points**, and your final grade is the average of the **best 10** results. A mix of conceptual questions and applied problem-solving exercises will be included. Do **not** spend more than two hours on each homework.

Practical Sessions (20%)
In these three-hour weekly sessions you will work in groups to discuss examples on the concepts introduced in your textbook readings and lecture presentations. Groups will apply these concepts and principles, in order to develop skills useful in scientific conceptual analysis and general problem-solving. Further work will focus on the development of experimental techniques related to Physics and the Scientific Method. The grade will depend on group quizzes (2%), notebook-recorded group activities (8%), and two experiment-based formal lab reports (1% and 9%) written in collaboration with your assigned group.

Attendance to the practicals is **mandatory** and a deduction to your final practical grade will be applied should you miss a session. More information will be provided during your first practical session (second week of classes) and on the course website.

Test #1 (10%)
The first test will be scheduled during **Week 6** and it will be **1 hour** long. This test will feature the material from the lectures and textbook readings up to and including the discussions of Week 5. The questions will also be based on the practical activities and online homework up to and including material due on Week 5. The format includes only multiple-choice questions. The only aids allowed are your non-programmable scientific calculator, and a hand-written, double-sided, and letter-sized aid sheet. Photocopies or computer printouts are not allowed.

Test #2 (20%)
The second test will be scheduled during **Week 10** and it will be **2 hours** long. This test will feature the material from the lectures and textbook readings up to and including the discussions of Week 9. The questions and problems will also be based on the practical activities and online homework up to and including material due on Week 9. The format includes multiple-choice questions as well as detailed problems. The only aids allowed are your non-programmable scientific calculator, and a hand-written, double-sided, and letter-sized aid sheet. Photocopies or computer printouts are not allowed.

Final Examination (35%)
The final examination will be scheduled during the exam period of **April 10 - 27**. Material for the final examination will include all the topics discussed in the assigned textbook readings, lecture presentations, online homework, and practical sessions. The final examination will be **3 hours** long and the format includes multiple-choice questions as well as detailed problems. The only aids allowed are your non-programmable scientific calculator, and a hand-written, double-sided, and letter-sized aid sheet. Photocopies or computer printouts are not allowed.

Class Policies

Name and Student Number
Any work you hand in must clearly indicate your name and student number, this includes practical activities, formal reports, 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 starts at 4:10 apm, and ends at 6:00 pm on Tuesday and 5:00 pm on Thursday. Late arrival or early departure from class 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 email, please first check the various threads in 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 email. This way you will also help other students facing the same issue. These discussions are 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 these electronic forums are not the best place for your query, make sure you send your email from an official **utoronto.ca** address (e.g., your UTmail+ account), as all other addresses will be filtered out automatically. For a quicker response time include the code **PHYA21** in the subject line of your message. I reply to emails within a period of 24 hours and I rarely reply to emails during weekends.

Absences
In order to ensure fairness in the assessment of all students, there will be no makeup options for practical activities, formal reports, or the tests. In the case of a **valid** and **documented** problem that supports an absence to a practical session, 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 first test, the second test will have its weight increased accordingly. In the case of a **valid** and **documented** problem that supports an absence to the second 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.utsc.utoronto.ca/vpdean/academic-integrity).

Course Support

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

Discussions Section
The course website supports electronic forums useful for questions and discussions on course content, conceptual and detailed problems, textbook 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 the Discussions on a regular basis to keep on top of current issues. You can also subscribe to the various threads in order to receive email notifications when new posts are available.

Lecturecasts and Lecture Notes
Videos of the lecture discussions will be available after each session and will remain accessible for one week. These videos are not meant to replace your participation in the lecture discussions. They are provided to help you review difficult material in preparation for other course components. The slides from the lectures will be made available on the course website after each lecture. To prepare for a lecture you should read the assigned textbook materials.

Physics Study Centre (PSC)
Held in SW503 outside the lab area, this centre is managed and run by the Environmental and Physical Sciences students' Association (EPSA) and the Department of Physical and Environmental Sciences (DPES). Selected outstanding volunteer students will be available to offer help with Physics questions and problems. The schedule will be posted at http://www.myepsa.ca/tutoring/physics-centre/

Class Schedule

This schedule is ***tentative*** and might change during the term in order to accommodate for variations in the lecture discussionss in response to student performance and understanding of the various topics. Please note that it is your responsibility to read the assigned sections and chapters **before** each lecture. The lecture discussions will **not** be a direct repetition of the basic material found in the textbook.

Failing to complete the readings before each lecture will hinder your ability to understand the class discussions, as a minimum understanding of the basic concepts from the assigned readings will be assumed as the starting point for all lecture discussions.

Dates	Tuesday Lectures 4m - 5pm / 5pm - 6pm	Thursday Lecture 4pm - 6pm
Jan. 08	**1D-Waves** Ch.16: 1 - 3	**Intensity and Doppler Effect** 16: 7 - 9
Jan. 10	**Sound and Light** Ch.16: 4 - 5	
Jan. 15	**Standing Waves** Ch.17: 1 - 4	**Beats** Ch.17: 8
Jan. 17	**Wave Interference** Ch.17: 5 - 7	
Jan. 22	**Electric Charge & Force** Ch.22: 1 - 4	**Field of Point Charges** Ch.23: 1 - 2
Jan. 24	**The Field Model** Ch.22: 5	
Jan. 29	**Continuous Distributions** Ch.23: 3 - 4	**Motion in Electric Fields** Ch.23: 6 - 7
Jan. 31	**The Capacitor** Ch.23: 5	
Feb. 05	**Electric Potential Energy** Ch.25: 1 - 3	**Multiple Charges** Ch.25: 6 - 7
Feb. 07	**Electric Potential** Ch.25: 4 - 5	
Feb. 12	**Potential & Field** Ch.26: 1 - 4	**Current & Resistance** Ch.27: 1 - 5
Feb. 14	**Capacitance & Dielectrics** Ch.26: 5 - 7	
Feb. 19	**Reading Week**	**Reading Week**
Feb. 21	**Reading Week**	
Feb. 26	**Circuit Laws** Ch.28: 1 - 3	***RC* Circuits** Ch.28: 9
Feb. 28	**Resistor Circuits** Ch.28: 4 - 8	
Mar. 05	**Magnetism** Ch.29: 1 - 3	**Magnetic Forces** Ch.29: 7 - 10
Mar. 07	**Magnetic Fields** Ch.29: 4 - 6	
Mar. 12	**Induction** Ch.30: 1 - 3	**Electromagnetic Waves** Ch.31: 1 - 6
Mar. 14	**Lenz & Faraday** Ch.30: 4 - 6	
Mar. 19	**Wave Optics** Ch.33: 1 - 2	**Einstein's Postulate** Ch.36: 1 - 5
Mar. 21	**Diffraction** Ch.33: 3 - 4	
Mar. 26	**Time & Length** Ch.36: 6 - 7	**Lorentz Transformations** Ch.36: 8
Mar. 28	**The Spacetime Interval** Ch.36: 8	
Apr. 02	**Relativistic Momentum** Ch.36: 9	**Relativistic Energy** Ch.36: 10
Apr. 04	**Causality** Ch.36: 9	