About Physics 142H

PHYS 142H. Honors: Elementary General Physics II (5 cr) Lec 4, lab 3. A continuation of PHYS 141 or 141H. Prereq: Good standing in the University Honors program or by invitation; PHYS 141 or 141H. Credit toward the degree may be earned in only one of: PHYS 142, 142H. Lab fee required. Topics covered include Electricity, Magnetism, Optics, Relativity, Atomic and Nuclear physics.

This is an introductory science course intended for students majoring in biological sciences, pre-health sciences, and related programs. It is a quantitative course focused on recognizing, analyzing and solving problems involving physical principles and situations as a means of gaining greater insight into and understanding of the principles and process that govern the world around us. We will examine on the evidence upon which scientists base their theories, and the methods with which they make predictions and test them. Some of the content and activities connected with the course is available only online and access to an active intenet connection will be required.

It is often said that the *language of science is mathematics*. This is indeed the case, to an extent, since key concepts and principles are most precisely articulated mathematically and the construction and manipulation of mathematical models is at the core of doing science. Therefore, it is essential that you have as a foundation the knowledge and skill with mathematical topics covered by MATH 102, especially the following topics: Arithmetic, Measurement and Units, Algebra, Scientific Notation, Significant Digits, Exponentials and Logarithms, Geometry, Trigonometry, and Vectors. These topics are These topics are summarized in an Appendix of the REQUIRED TEXT. Although Calculus is not required, it will help you to better appreciate some of the mathematical analyses that we will perform.

ACE INFORMATION (https://canvas.unl.edu/courses/149517/pages/achievement-centered-education-ace-information)

About the Instructor

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Your instructor joined the UNL faculty the year Harold V became King of Norway. Prof. Ducharme leads a Research Team working with Molecular Electronics and teaches Physics and Astronomy courses at UNL.

He is devoted to Nanoscience Outreach and Education and to improving Science Education.

Prof. Ducharme is a member of the Board of Directors of Branched Oak Observatory, a multispectral Astronomy Park located just northwest of Lincoln. He also likes to Race Sports Cars.

Instructor	Stephen Ducharme, Professor Department of Physics & Astronomy Nebraska Center for Materials & Nanoscience University of Nebraska-Lincoln
Contact Information	**Office:** JH 310F (map to JH, Jorgensen Hall) **Zoom Office:** https://unl.zoom.us/my/spducharme **Email:** sducharme1@unl.edu (put "PHYS142H" in the Subject) **Phone:** (402) 472-8590 Home Page; Calendar; Zoom
Course Meeting Times	• Lecture: MW 12:30 to 2:20 PM in JH 145 • Lab: MW 12:30 to 3:20 PM in JH 110
Office Hours	• MW 10 am to 12 pm in JH 310 F I am generally available by phone, Zoom, or email weekdays from 8:30 AM to 5:30 PM, although I have meetings and appointments scattered throughout the week. Please check my Calendar for available times. You are welcome to contact my by email after hours and on weekends, but it may take me longer to respond. You also can find help at the physics resource and tutoring center.

Course Policies

Methods of Instruction: The design and execution of this course is based on the principle of "student-centered learning", which recognizes that learning best arises from student engagement with the subject, with peers, and with instructors. While there will be some lecturing, research shows just listening to a lecture is a poor way to gain deep understanding and retention of scientific concepts. Instead, you must engage with the material through "hands-on" practice of the content, and that learning from and explaining your understanding to your peers is extremely valuable. Your instructor has the responsibility of putting things in context and guiding you through the learning process, but the ultimate responsibility for learning the content falls on the student. Thus this course is structured as follows.

Time Commitment: Expect to spend 6 to 12 hours per week outside of class on reading and class preparation, preclass quizzes, follow-up study, homework, and other tasks as recommended or assigned. You are expected to participate fully in course learning activities both in and out of class.

- Asynchronous online activities both before and after each scheduled class and lab session.
- Cooperative learning activities during each scheduled class and lab session.

Attendance and Participation: In order to satisfy the structure for this course, you are expected to attend every class to engage in the material. Since much of the learning will be accomplished in class by interacting with peers, your attendance and participation is essential to the success of the entire class. For synchronous activities (scheduled class and lab times): arrive in the classroom (or connect on Zoom) and be ready to work when class begins; be fully engaged and participate in all activities so that you *and* your classmates may obtain the full benefit of the class; and stay engaged until class is dismissed.

Instructional Continuity Plan: In the event that in-person classes are cancelled, for example, due **inclement weather (https://bf.unl.edu/policies/inclement-weather%20)** , the lecture sessions will meet remotely over Zoom at the regularly scheduled time. I will provide a link and instructions in the course **Announcements (https://canvas.unl.edu/courses/149517/announcements)** on Canvas. Instructions for the lab sessions will be communicated separately.

Technology Policies:

- You will need access to a personal computer with internet access sufficient bandwidth to handle videos and Zoom meetings.
- Check Canvas regularly, at least once per day, for schedules and announcements. If I have an important message to send you between classes, I will use the Canvas Email system, so please make sure that the email address that it has for you is current and that you check that email address regularly.

- Cell phone use is strictly prohibited during synchronous activities (class and lab times). Turn of your ringer and other audible alerts.
- Stay focused on the class. This means that you have only class-related apps and browser windows on your screen.

Assignment Deadline Policies: You are responsible for following the calendar and deadlines by viewing all *required online materials* assigned before class and and completing all assignments on time. Late work will receive zero or reduced credit. Exceptions *may* be made at the instructor's discretion if for unavoidable, reasons (e.g., illness or family emergency), provided you request this from your instructor in writing with full documentation as soon as possible, but no later than 48 hours after you are able to return to classes.

Instructor Discretion Policy: Exceptions to course policies will be made at the instructor's discretion without waiving the right to enforce those policies at a later date. For example, if the instructor accepts a late assignment from a student in any instance, that does not mean that this exception will be granted to another student or at another instance. Your instructor pledges to make all exceptions as fairly as possible, but they are still at the instructor's discretion.

Academic Integrity and Honesty: Academic Integrity and Honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. The University's **Student Code of Conduct (https://studentconduct.unl.edu/student-code-conduct)** addresses academic dishonesty. Students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision.

Class Conduct Policies: Some aspects of expected behavior during class time were covered above, but I will reiterate that I expect you to come to class prepared to learn, and that you foster a positive learning environment for yourself and your fellow students. Please participate actively in group and class cooperative activities, and please remain silent when appropriate. Please be respectful of everyone in both your language and conduct. That respect includes both personal respect and creating the proper classroom environment. If you need to visit the restroom, you do not need to seek permission, just leave quietly and return quietly as soon as you can.

Copyright, Intellectual Property, and Confidentiality: All course materials, assessments, videos, communications, and other materials provided in this course are copyrighted and are the intellectual property of the original publisher, instructional staff, or the University of Nebraska and should not be disseminated or in print or electronically unless in compliance with applicable law and with appropriate attribution to the source. All classes are closed to the Press/Media. No video or audio taping of class sessions is allowed unless you obtain my permission to do so. To protect the privacy of class members and instructional staff, the products of this course, such as student assignments, online discussions, and class recordings are considered confidential and may not be disseminated outside the class members. This doesn't mean that what we do is necessarily secret, but mainly that

some of these products, especially student work and cooperative activities, identify individual class members who should have the reasonable expectation of privacy outside of the class.

See also the **University-Wide General Course Policies and Resources (https://executivevc.unl.edu/academic-excellence/teaching-resources/course-policies) .**

Textbook and other Course Materials

The required course textbook is *Physics, 11th edition*, by Cutnell and Johnson (Wiley 2018, vol. 2)

> You don't need to purchase the textbook, because an electronic version (eBook) has been incorporated into the Canvas page for the course.
> You may access the eBook free VitalSource BookShelf app.
> You may purchase a printed copy of the textbook if you wish. Make sure to get a copy of the 11th edition, volume 2 or a combined volume 1 & 2.

iClicker or Reef account *Required* to use the student response system in class. Follow these **instructions (https://its.unl.edu/downloads/srs/Register%20your%20iClicker%20in%20Canvas..pdf)** .

Other *Required* Supplies: A pen or pencil, ruler and a protractor, and a scientific calculator will all be needed. Bring all of these to *every class and lab* session.

Course Schedule

Latest Version on top. Subject to Change. Changes in Blue Text.

Spring 2022			1/20/23 Physics 142H Lecture Schedule		
Wk#	**Date**	**Ch.**	**Sect.**	**Title**	**Projects**
1	23-Jan	18	1-5	Electric Forces	
	25-Jan	18	6-10	Electric Fields	
	27-Jan	Lab 1		Electric Forces and Electric Fields	
2	30-Jan	19	1-3	Electric Potential Energy & Electric Potential	
	1-Feb	19	4-6	Capacitors & Dielectrics	
	3-Feb	Lab 2		Storing Charge	
3	6-Feb	20	1-5	Ohm's Law & Electric Current	P1 Outline
	8-Feb	20	6-9	Electrical Circuits	
	10-Feb	Lab 3		Batteries and Bulbs	
4	13-Feb	20	10-14	Circuit Analysis	
	15-Feb	21	1-5	Magnetic Forces & Fields	
	17-Feb	Lab 4		Going Around a Loop	P1 Draft
5	20-Feb	21	6-9	Magnetic Fields & Electric Currents	
	22-Feb		in class	Test 1: Electricity and Magnetism	
	24-Feb	Lab 5		Bioelectronics	
6	27-Feb	24	1-3	Electromagnetic Waves & Light	
	1-Mar	24	4-6	Properties of EM Waves	P1 Final
	3-Mar	Lab 6		Sending a Signal	
7	6-Mar	25	1-4	Reflection & Image Formation	
	8-Mar	25	5-6	Spherical Mirrors & Imaging	
	10-Mar	Lab 7		Currents and Magnets	
	12 to 19 March			Spring Break (no class)	
8	20-Mar	26	1-5	Refraction	
	22-Mar	26	6-9	Lenses & Imaging	
	24-Mar	Lab 8		Measuring the Electron Mass	
9	27-Mar	26	10-14	Optical Instruments & the Eye	
	29-Mar	27	1-4	Wave Superposition and Interference	
	31-Mar	Lab 9		Forming Images	
10	3-Apr	27	5-9	Wave Diffraction	
	5-Apr		in class	Test 2: Light and Optics	
	7-Apr	Lab 10		The Amazing Eye	
11	10-Apr	29	1-4	Waves as Particles	
	12-Apr	29	5-6	Particles as Waves	
	14-Apr	Lab 11		Wave Properties of Light	
12	17-Apr	30	1-4	Hydrogen Atom	P2 Outline
	19-Apr	30	5-10	Periodic Table	
	21-Apr	Lab 12		Using a Spectrometer	
13	24-Apr	31	1-3	Nuclear Structure & Binding Energy	
	26-Apr	31	4-7	Radioactive Decay (supplement - Franklin Ch 40)	
	28-Apr	Lab 13		Radiation Safety	P2 Draft
14	1-May	31	8-9	Radiation Interactions (supplement - Franklin Ch. 41)	
	3-May	32	1-2	Biological Effects of Radiation (suppl. - Franklin 42)	
	5-May	Lab 14	--	Creating Images with Radiation	
15	8-May	F43	all	Medical Imaging	P2 Final
	10-May	F44	all	Magnetic Resonance Imaging	
	12-May	Lab		TBD	
Finals Week	15-Jan	Test 3	3:30 to 5:30 PM JH 145	Test 3: Atomic and Nuclear Physics	**Test 3**

UNL Schedule	https://registrar.unl.edu/academic-calendar/#tab2
Final Exam Schedule	https://registrar.unl.edu/final-exam#tab1

Assessment and Grades

Quizzes: The Reading Quiz includes multiple-choice and short problems from the assigned reading. The PreClass quizzes address conceptual understanding and provide feedback to the instructor. They are designed around the method of "Just-In-Time Teaching," which is a widely used, scientifically tested, method for informing the instructor about student readiness just prior to class. Reading and PreClass quizzes must be completed by 9:00 AM the day class meets.

Participation: Participation will be assessed according to contributions to general discussions, concept questions, class exercises, and group exercises.

Projects: You will have to complete one or two short "projects" related to the class content. These are not term papers or lengthy semester-long projects, but are opportunities for you to have a unique learning experience that suits your interests and talents.

Tests: There will be Three tests as listed in the **Course Schedule (https://canvas.unl.edu/courses/149517/pages/course-schedule)** . The Tests will be closed book, with an equation sheet supplied by the instructor. See the **Test Conditions (https://canvas.unl.edu/courses/149517/pages/about-tests)** for other stipulations.

Laboratory: You must register for and attend a weekly Physics 142H laboratory section.

Final Grade: The final letter grades, including +'s and −'s, will be determined at the end of class. However, it is reasonable to expect that it will be very similar to the ranges listed above. Your grade will depend on your work and your performance in the class, and not based on a "scale" or other measure relative to your peers. Since this is an Honors class, you will be expected to work at a higher level than a regular section, but your grade will be

Item	**Fraction of Grade**
Tests	45%
PreClass Assignments	10%
Participation	5%
Home Work	15%
Projects	10%
Laboratory	15%
Total	**100%**
Grade	**Points Earned**
Some type of A	≥ 85%
Some type of B	≥ 75%
Some type of C	≥ 65%
Some type of D	≥ 55%

determined based on the expectations of the general Physics 142 class.

ACE Information

(i) the ACE Outcome(s) for which the course is certified

Student Learning Objective 4 (SLO 4): Use scientific methods and knowledge of the natural and physical world to address problems through inquiry, interpretation, analysis, and the making of inferences from data, to determine whether conclusions or solutions are reasonable.

(ii) the opportunities the course will give students to acquire the knowledge or skills necessary to achieve the Learning Outcome(s)

Mathematics and Statistics

The course makes extensive use of mathematical analysis as a central and essential component of estimation, problem solving, and evaluation of solutions. The mathematical methods most used are algebra, trigonometry, vectors, unit analysis, and numerical computation.

Critical Thinking

The course emphasizes the development of mature appraisal and problem solving techniques, which involve C**ritical Thinking** at three key stages. First, in setting up the analysis, students must learn to identify the essential physical principles and to which part of the system or process they apply. Second, in developing the solution, the students must identify useful and valid assumptions about how the system should behave, and relate this to the mathematical representation of the solution. Third, the students must evaluate and test the solution for reasonableness and accuracy. This is particularly important when they are working with phenomena, such as the behavior of subatomic particles, that are not part of everyday experience, or the validity of assumptions and approximations, such as the neglect of friction when its effects have insignificant influence on the outcome. Even in the case of everyday experience, the must learn to challenge their own, frequently flawed, preexisting conceptions.

Problem Solving

Problem solving is by far the main activity in the course. Therefore most of the effort in the course is focused on the process and tools for solving problems involving physical systems.

(iii) the graded assignments which the instructor(s) will use to assess the student' achievement of the Outcome(s).

Student abilities for appraising physical situations is assessed in several ways. The course grade is based on a cumulative score that is derived from the following components, which are all graded and weighted according to the breakdown given in the syllabus. For each lecture assessment activities include student responses to (i) pre-class quizzes, (ii) in-class exercises, and (iii) follow-up homework exercises and problems. For the weekly laboratory sessions, students are assessed based on vi) lab-preparation quizzes and vii) a report of the results, analysis, and conclusions drawn from the laboratory results. Progress in the course as a whole is assessed with (viii) unit midterm exams. The pre-class quizzes, concept questions, and some of the homework exercises focus on specific

knowledge, basic computational skills, and grasp of key concepts. The students' integrative understanding of physical principles and problem-solving is assessed with the more complex homework problems, in-class exercises, and the exams.

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