University of Wyoming
PHYS 1220 Section 02
Engineering Physics II, 4 credits
Enzi STEM Building Room 195
Fall Semester 2026
MWF 1:10–3:00 PM, Aug 31–Dec 11, excluding university breaks

Instructor

Richard Barrans, Ph.D., M.Ed., Assistant Lecturer, Physics and Astronomy
PS 116, no phone in office, rbarrans@uwyo.edu.
Office Hours: PS 116: M 4:10–5:00 PM, W 11–11:50 AM; PS 234: T, W 7–8 PM

Teaching Assistant

Ruel Malcolm, office hour M 11:00 AM–noon, PS 103 C
Dilip Rijal, office hour 11:00 AM–2:00 PM, PS 227

Enrollment Restrictions

Students must have received a grade of C or higher in MATH 2200 (Calculus I) and MATH 2205 (Calculus II) and have completed or be currently taking MATH 2210 (Calculus III). Students receiving credit for PHYS 1220 cannot receive credit for PHYS 1050, 1120 or 1320. Prior completion of PHYS 1210 or equivalent is expected. Physics and Astronomy majors are encouraged to enroll in this section.

Course Description

Welcome to introductory physics for engineers and scientists! This course is an introduction to thermodynamics, electricity, and magnetism. You will observe, study, model, explain, and predict the specific forces that influence matter and the principles determining how they behave. Thermodynamics is fundamental to understanding how and why physical systems change over time, and how they can be harnessed to achieve desired results. Electricity and magnetism are the most accessible of the fundamental forces affecting matter, explaining most of the materials and phenomena surrounding us.

Student learning outcomes

Physics & Natural World Student Learning Outcomes

- Understand the principles of the scientific method.
- Formulate and test ideas through analysis and interpretation of the data.
- Use quantitative data analysis as the basis for making critical judgements and drawing conclusions.

Physics & Natural World Critical & Creative Thinking Student Learning Outcomes

- Separate facts from inferences and relevant from irrelevant information, and explain the limitations of information.

- Evaluate the credibility, accuracy, and reliability of conclusions drawn from information.
- Analyze one's own and others' assumptions and evaluate the relevance of context when presenting a position.

Engineering Physics Student Learning Outcomes

- Explain and predict how interactions between objects affect their motion.
- Use principles of conservation to predict how objects behave.
- Construct and apply mathematical models to describe and explain physical phenomena.
- Understand the principles of the scientific method.
- Use quantitative data analysis as the basis for making critical judgements and drawing conclusions.
- Separate facts from inferences and relevant from irrelevant information and explain the limitations of information.
- Evaluate the credibility, accuracy, and limitations of conclusions drawn from information.
- Communicate ideas in writing using appropriate documentation.

Required Materials

Textbook: Mastering Physics with Pearson eText Access Code (18 weeks) for University Physics with Modern Physics, 15th Edition, by Young and Freedman, published by Pearson Addison Wesley. Available via WyoCourses through StartRight+.

Grading scale and grading policy

The final grade will be determined from cumulative points attained. Grading will be on a standard scale (90's = A, 80's = B, 70's = C, 60's = D, < 60% = F). Standards comprise 75% of the course grade, and labs comprise 25%.

Standards: Standards are specific skills that I recognize as evidence of mastery of the course content. The list of standards is on the course website at barransclass.com. The quiz, midterm exams, and the final exam contain questions that probe your understanding of the standards. Your performance on the questions for a standard determines whether you satisfy the standard or not.

If you don't satisfy a standard on the first assessment, you automatically qualify to try again at the next scheduled retest. If you don't satisfy the standard then, you may continue to retest, but you must meet with me, a TA, or a tutor to review the standard before each retest. If you meet with a TA or tutor, have them notify me of the session. I won't keep a record of which standards you have reviewed, just that you have done a review. Reviewing the necessary content is up to you.

There is no penalty for needing more than one try to satisfy a standard. Whenever a standard is satisfied, it receives full credit.

Labs: You must average **at least 60% on the labs** to pass the course. If your lab average is less than 60%, you will receive an F for the course regardless of your scores on the standards.

A note about grades: Your grade in this course reflects your performance over a 15-week period on a limited set of contrived evaluations. It does not reflect your worth as a person or what I think of you. Because of the scope of this course, and because it comprises only a small fraction of your college career, your grade is not a prediction of your future success nor an evaluation of your career potential. In short, please do not suffer by making more of your grade than it really is.

General requirements and expectations for the course

Attendance Policy

Attendance is expected in class, but there is no explicit grade for attendance. Attendance in a lab is required to receive credit for the lab. If you have an excused absence from lab, we may arrange a make-up lab for you, or the lab may be pro-rated.

If you are absent without excuse from an exam or retest, you receive zero credit.

Late work

Late lab reports will be penalized 5% for every school day late, to a minimum of 50%. However, I will not accept submission of more lab reports in any week than there are weeks remaining in the semester.

Integrated Lecture/Lab

Since ideas and definitions from the text will be used freely in class, it is necessary for you to read and study the assigned chapters before class. I will avoid presenting the exact examples in your text. Instead, class meetings are for addressing the difficult points in the text as well as for helping to place the readings "in the big picture." The more actively engaged you are in class, the better you will learn and perform. Hence, there will be frequent conceptual questions posed in class—questions that you will be expected to discuss with your neighbors.

Laboratory participation is required.

Homework

The assignments will be posted on-line via the MasteringPhysics website, which is integrated with the WyoCourses course shell. Students are encouraged to work together on homeworks, but each student should aim to understand each problem. The due date for each homework will be indicated; typically one week after being assigned. Since homeworks are intended for practice, I intend to leave them open to students after their due dates. If a homework is accidentally closed to you, please let me know and I will try to fix it.

MasteringPhysics.com advice and information:

- "Inclusive access" to the textbook is available with purchase of MasteringPhysics through WyoCourses. You should be able to access MasteringPhysics directly from the WyoCourses shell.

- Don't use the browser's "back" button. Use the links provided.
- You will be able to submit each answer repeatedly, and full credit can be earned even on the final attempt (however, no credit will be awarded if you do not initially answer correctly on a two-part multiple-choice problem; partial credit only will be awarded if you initially answer wrong on a three-part multiple-choice problem, etc). Please hit "submit" after answering each question. Selecting "submit problem" will result in the problem being graded. Selecting "submit problem" voids the option of additional attempts!
- Some problems have multiple components, so be sure to answer each portion.
- Many problems have hints to help you along the way. You will not be penalized for looking at the hints, although sometimes bonus credit (3%) will be awarded if you answer correctly without peeking at the hints. Either way, you win. Note that this possible bonus credit will be an extremely tiny fraction of your overall course grade, so please don't agonize over the choice.
- Parameters may be randomized! Your friend's question may have different numbers.
- There is a 2% tolerance for answers; e.g. you can be off by, say, 1.8% and receive full credit.

Entering formulas in Mastering Physics:

Sometimes Mastering Physics will ask you to enter algebraic formulas as your answers. Here is a chart on how to convert common formulas into Mastering Physics symbolic language. Also, be sure to do homework #0 where you get to practice this.

Formula	***Mastering Physics Coding***
$\frac{1}{2}\, a_x t^2$	1/2 a_x t^2 or 1/2 * a_x * t^2
$\mu_s / (F_1+F_2)^2$	mu_s / (F_1+F_2)^2
$\sqrt{a^2+b^2}$	sqrt(a^2 + b^2)
$v_0^2 + a\Delta t$	v_0^2 + a Delta t
3×10^8	3 * 10^8

Quizzes and retests

Quizzes and retests will be closed book and closed notes. You may use a calculator. You are permitted to bring one 8.5"×11" note sheet with information on both sides to an exam, and a 3"×5" index card to a retest (one card per standard).

Quizzes 1–5 and all retests will be administered in CR 118, and Quiz 6 will be administered in STEM 195, the regular classroom. If you have a conflict with an exam time, make prior arrangements with the instructor.

Internet

Lecture slide shows, lab instructions, class work sheets, and standards are posted on my personal website, www.barransclass.com.

Required Participation Outside of Class Meetings

Quizzes and standards retests are scheduled for Thursday evenings 5:10–7:00 PM in CR 118. Thursday evenings are reserved for Calculus exams as well, so the physics and math instructors have coordinated our schedules to avoid conflicts. Let me know as soon as possible of any conflicts you encounter; I'll do my best to accommodate you.

To retest on a standard after its first scheduled retest, you must review the material with me, a TA, or a tutor outside of class.

Final Exam Date

Friday, December 12, set by the registrar. If you are not able to attend the final exam as scheduled, notify me before the Thanksgiving break to arrange an alternative.

Classroom Behavior Policy

Students are expected to respect others' opinions and abilities, and to help each other during group work activities. Personal attacks, offensive language, name-calling, and dismissive gestures are not warranted in a learning atmosphere. As the instructor, I have the duty to dismiss anyone interfering with a student's opportunity to learn from the classroom, study sessions, exams, office hours, electronic forums, and other areas where such behavior occurs.

Electronic Devices

If you have a cell phone or any other personal audio equipment, ensure that it does not make noise or cause a distraction during class. Laptops and tablets are permitted for note-taking and class activities. To protect the privacy of your fellow students, no unauthorized video or audio recording during class is allowed. If you require recording for accommodation of disabilities, work with Disability Support Services and me to accommodate your needs.

Diversity

The University of Wyoming values an educational environment that supports students of all backgrounds and viewpoints. Diversity of viewpoints is considered a resource for learning. Topics may be difficult, not only intellectually but emotionally; however, discussions are essential to meeting the course's student learning outcomes and assisting students in developing problem-solving and critical-thinking skills. During all conversations, respect and civility are of utmost importance.

Disability Support

The University of Wyoming is committed to providing equitable access to learning opportunities for all students. If you have a disability, including but not limited to physical, learning, sensory or psychological disabilities, and would like to request accommodation in this course due to your disability, please register with and provide documentation of your disability as soon as possible to Disability Support Services (DSS), Room 128 Knight Hall.

You may also contact DSS at (307) 766-3073 or udss@uwyo.edu. It is in the student's best interest to request accommodation within the first week of classes, understanding that accommodations are not retroactive. Visit the DSS website for more information at: www.uwyo.edu/udss. Once UDSS informs me of the accommodations appropriate for you, I will implement them.

Academic Dishonesty Policy

Academic honesty develops respect between faculty and students, ensures fair and effective grading, and creates an environment that fosters learning. Although I encourage you to study with other students, any assignments, exams, and lab submissions must represent your own work.

Academic dishonesty will not be tolerated in this class. Academic dishonesty means anything that represents someone else's ideas as your own without attribution. It is intellectual theft—stealing—and includes (but is not limited to) unapproved assistance on examinations, plagiarism (use of any amount of another person's writings, blog posts, publications, and other materials without attributing that material to that person with citations), or fabrication of referenced information. Facilitation of another person's academic dishonesty is also considered academic dishonesty and will be treated identically. Cases of academic dishonesty will be treated in accordance with UW Regulation 2-114. The penalties for academic dishonesty can include, at my discretion, an "F" on an exam, zero credit for a standard without the right to retest, or an "F" in the entire course.

Physics is fun. Involvement in a case of academic dishonesty is not fun.

AI Technology

Students are permitted to use advanced automated artificial intelligence or machine learning tools on assignments in this course if that use is properly documented and credited. For example, text generated by ChatGPT-3 should include a citation such as "Chat-GPT-5. (YYYY, Month DD of query). "Text of your query." Generated using OpenAI. https://chat.openai.com/" Material generated using other tools should follow a similar citation convention. If you use AI for another task, such as brainstorming, editing, or proofreading, that should be cited similarly.

Duty to Report

UW faculty are committed to supporting students and upholding the University's non-discrimination policy. Under Title IX, discrimination based upon sex and gender is prohibited. If you experience an incident of sex- or gender-based discrimination, we encourage you to report it. While you may talk to a faculty member, understand that as a "Responsible Employee" of the University, the faculty member MUST report information you share about the incident to the university's Title IX Coordinator (you may choose whether you or anyone involved is identified by name). If you would like to speak with someone who may be able to afford you privacy or confidentiality, there are people who can meet with you. Faculty can help direct you or you may find info about UW policy and resources at http://www.uwyo.edu/reportit.

You do not have to go through the experience alone. Assistance and resources are available, and you are not required to make a formal complaint or participate in an investigation to access them.

Green Dot Program at UW

Here at The University of Wyoming, we are committed to reducing and preventing power-based personal violence such as sexual assault, relationship violence, and stalking. Green Dot is a bystander intervention program to reduce these forms of violence with one thought; If everyone does one thing, no one will have to do everything. A Green Dot is your choice at any moment to make campus safer by promoting safety for everyone and letting others know that you will not tolerate violence. A Green Dot is any behavior, choice, word or attitude that sends a clear message that:

1. Violence is not okay with you, and
2. Everyone is expected to do their part.

Additional information on Green Dot training and resources are available at http://www.uwyo.edu/greendot/.

Substantive changes to syllabus

Information in the syllabus was, to the best knowledge of the instructor, correct when distributed at the beginning of the term. All deadlines, requirements, and course structure are subject to change if deemed necessary by the instructor. If any changes to the syllabus become necessary, students will be notified in class and on WyoCourses. Please check your university email daily.

Student Resources:

- DISABILITY SUPPORT SERVICES: udss@uwyo.edu, 766-3073, 128 Knight Hall, www.uwyo.edu/udss
- COUNSELING CENTER: uccstaff@uwyo.edu, 766-2187, 766-8989 (After hours), 341 Knight Hall, www.uwyo.edu/ucc
- ACADEMIC AFFAIRS: 766-4286, 312 Old Main, www.uwyo.edu/acadaffairs
- DEAN OF STUDENTS OFFICE: dos@uwyo.edu, 766-3296, 128 Knight Hall, www.uwyo.edu/dos
- UW POLICE DEPARTMENT: uwpd@uwyo.edu, 766-5179, 1010 E. Ivinson Ave., www.uwyo.edu/uwpd
- STUDENT CODE OF CONDUCT WEBSITE: www.uwyo.edu/dos/conduct
- UW TUTORING RESOURCES: https://www.uwyo.edu/step/index.html

Free tutoring available

Tutoring for this class is available at the STEP Tutor Center. Use the Penji app to make an appointment for free tutoring: enter your UWYO email address, and log on via WyoWeb. New users need to set up a profile before finding tutoring. For more information, please visit www.uwyo.edu/step/.

Tentative Schedule

Date	Topic (Standard)	Textbook Reading
08/31	Temperature (1, 2)	17.1–3
09/02	Heat (3)	17.4–17.6
09/04	Heat transfer (4,5), error propagation	17.7
09/07	**Labor Day—No class**	
09/09	Ideal gas EOS, heat capacities (6, 7)	18.1–18.4
09/11	**Lab 1**: Specific heat	
09/14	Phases of matter (8)	18.6
09/16	Thermodynamic paths (9)	19.1–19.3
09/17	**Quiz 1 5:10–6:00 PM, xx**	
09/18	Thermodynamic processes of ideal gases (10)	19.4–19.8
09/21	**Lab 2**: Ideal gas law	
09/23	Entropy (11)	20.5, 20.7
09/25	Entropy (12)	
09/28	Refrigerators and heat engines (13)	20.1–20.4, 20.6
09/30		
10/01	**Quiz 2, Round 1 Retests, 5:10–7:00 PM, CR 118**	
10/02	Electric charge, Coulomb's law (14)	21.1–21.5
10/05	Electric field (15)	21.6
10/07	Gauss's law; conductors (16)	22.1–22.5
10/09	**Lab 3**: Charge distribution	
10/12	Semester Break—No class	
10/14	Electric potential (17)	23.1–23.5
10/15	**Quiz 3, Round 2 Retests 5:10–7:00 PM, CR 118**	
10/16	Capacitance (18)	24.1–24.3
10/19	Capacitor geometry (19)	
10/21	Dielectric capacitors (20)	24.4–24.6
10/23	**Lab 4**: Capacitance	
10/26	Resistance, resistivity, and Ohm's law (21, 22)	25.1–25.5
10/28		
10/29	**Quiz 4, Round 3 Retests 5:10–7:00 PM, CR 118**	
10/30	**Lab 5**: Resistivity	

11/02	DC Circuits (23)	26.1–26.3
11/04	DC Circuits (24)	
11/06	RC Circuits (25)	26.4
11/09	**Lab 6**: RC time constant	
11/11	Magnets and magnetic field; Lorentz force (26, 27)	27.1–27.3
11/12	**Quiz 5, Round 4 Retests 5:10–7:00 PM, CR 118**	
11/13	Magnetic fields of currents (29)	28.1–28.5
11/16	**Lab 7**: Magnetic field	
11/18	Ampere's law (30)	28.6–28.7
11/20	Electromagnetic induction and motional emf (31)	29.1–29.4
11/23	**Quiz 6, No Retests, STEM 195**; Maxwell's Equations	29.5–29.7
11/25	**Thanksgiving Break—No class**	
11/21	**Thanksgiving Break—No class**	
11/30	**Lab 8**: Electromagnetic induction	
12/02	Inductors (32–34), RL circuits (35), transformers (36)	30.1–30.4, 31.6
12/04	Resonant circuits (37)	30.5
12/07	Practice	
12/09		
12/10	**Round 5 Retests 5:10–7:00 PM, CR 118**	
12/11	Practice	
12/18	**Final exam, Round 6 Retests 1:15–3:15 PM, TBD**	