

Fundamentals of Physics

Instructor: Alexander Wagner
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<http://www.ndsu.edu/physics/people/faculty/>

Bulletin description: Application of Physics concepts and principles to the real world.
Topics selected from mechanics, heat, optics, electricity, and magnetism.

General Education Approved Course for the Science & Technology (S) category:

This course has been approved by the NDSU Faculty Senate to meet the requirements for the Natural and Physical Science Learning Outcome. Students will (i) analyze components and dynamics of natural and physical worlds, (ii) develop models to explain phenomena within the natural and physical worlds, and (iii) apply methods of scientific inquiry to enhance their understanding of the natural and physical world.

Goals: This course provides students with a basic overview of physical theories developed to predict the behavior of our environment. It will guide them in their everyday lives and careers as informed members of our society.

Meetings: 15:30 - 16:45 Tuesday, Thursday in A. Glenn Hill Center, room 112

Attendance: According to NDSU policy 333 attendance in classes is expected. Absences for NDSU sponsored extracurricular activities will be excused when appropriate documentation is provided. Online homework should be completed by the stated deadline. For medical reasons or family emergencies homework extensions will be granted on request. It is expected that extensions are requested before the expiration of the deadline whenever possible.

Office hours: 2:00pm - 3:00pm Tuesday, or by arrangement

Text: Physics, Concepts & Connections, Art Hobson (recommended)
Optional: David C. Lindberg, *The Beginnings of Western Science*

Schedule: What is science?, Astronomy
Atoms, how things move, why things move,
Newton's universe, conservation of energy,
Second law of thermodynamics, electromagnetism,
Waves & light & climate change, special theory of relativity,
Einstein's universe and the new cosmology, the quantum idea,
The quantum universe, the nucleus and radioactivity,
Fusion and fission, the energy challenge, quantum fields
We will cover about one chapter each 1.5 weeks.

Blackboard: This class uses LON-CAPA instead of blackboard as its main content management system. LON-CAPA can be accessed by selecting the appropriate server at http://www.ndsu.edu/physics/lon_capa/. Your username is everything before the @ in your ndsu email address. Follow the “forgot password” link to set your password. Please contact Paul.Omernik@ndsu.edu with any technical issues.

Grading:

Problems in LON-CAPA:	20pts
Test 1, Sept. 22:	20pts
Test 2, Oct 20	20pts
Test 3, Dec. 1:	20pts
Final, Dec 13, 8am-10am:	20pts
Project presentation (varies):	20pts
Participation, extra essay homework: bonus points (up to 20 points)	
Only the 5 best scores count. (The lowest is dropped, can be any of the above).	
Grading scale: A:100-85, B: 84-68, C: 67-50, D:49-40, F: 39-0	

General Education Outcomes and Student Learning Assessment:

Both exam questions and homework problems will assess the degree of having reached our General Education Approved learning outcomes. Each exam and homework question is designed to assess one of the following abilities:

1. Extract and analyze relationships that reflect underlying physical laws.
2. Analyze the components that determine the behavior of a physical system.
3. Predict the behavior of a physical system in a quantitative manner.
4. Learn how to build models of physical systems and use them to make predictions. Applications include developing astronomical models for problems not available on google, as well as unconventional mechanical and quantum mechanical problems.
5. Apply the method of scientific inquiry as a tool to understand our physical world. This involves an iterative approach of observing, making hypothesis, and testing the predictions entailed by the hypothesis.
6. Apply general physics laws to new, previously not encountered situations.

Abilities 1-3 relate most closely to Learning Outcome 1: *Students will analyze components and dynamics of natural and physical worlds.*

Ability 4 relates most closely to Learning Outcome 2: *Students will develop models to explain phenomena within the natural and physical worlds.* Abilities 5 and 6 relate most closely to Learning Outcome 3: *Students will apply methods of scientific inquiry to enhance their understanding of the natural and physical world.*

Illness: Do not come to class if you are sick. Please protect your health and the health of others by staying home. If you are unable to attend class at the regularly scheduled time due to illness, contact the instructor for alternate arrangements, especially for exams and extensions of homework due dates.

* No makeup exams will be scheduled. Only the 3 best grades of the tests count towards

the final grade.

Resources for Students on campus and remotely (telehealth):

- Counseling Services: 701-231-7671; <https://www.ndsu.edu/counseling/>
- Disability Services: 701-231-8463; <https://www.ndsu.edu/disabilityservices/>
- Student Health Service: 701-231-7331; <https://www.ndsu.edu/studenthealthservice/>
- Dean of Students Office: 701-231-7701; <https://www.ndsu.edu/deanofstudents/>

AI policy: We are all navigating the rise of generative AI systems. The capabilities of Chat GPT, Claude or similar systems are now approaching a quality where they will typically outperform students in solving homework problems or preparing projects on their own. Nonetheless they are projected to become a useful component of many job descriptions where those jobs aren't outright replaced by AI. I feel that it is therefore important to work carefully consider the useful ways in which AI may be incorporated into student learning. I am hoping that we will be able to exchange experiences we have with AI, and be able to discuss ways in which its use is (or really isn't) helpful to the learning process.

- Homework: the problems in the homework are preparing you for taking the tests. During the tests you will not have access only to a pencil and a calculator (and not a calculator app on a smartphone or tablet). It is therefore important that you fully understand homework problems and would be well prepared to solve similar problems without the help of AI. What may be useful, however, is to use an AI in a way similar to a TA helpdesk or direct communication with your instructor. Doing this will require a significant amount of self-discipline by the student, to ensure that they are learning the concept and not simply getting a correct answer. Since this isn't reasonably policable, however, this use of AI is not strictly forbidden in this class, but we encourage students to be very judicious about its meaningful uses.
- Tests: no use of AI will be tolerated during tests, which are taken in class during lecture times. Feel free to inform me if you notice any use of AI during the taking of a test, since such use is highly unfair to the students that aren't cheating. In the past the inforcement was less strict, leading to very valid student complaints.
- Project: since most of the work on the project is performed by you at home AI usage isn't meaningfully policable. Instead we require you to give proper credit to any work performed by AI. And since you will be presenting your work, you will also be able to answer detailed questions about your presentation, the results you present and your choice of analysis tools for the presented results. This means that if you use AI you have to make sure that you fully understand what the AI has prepared for you.

Additional Information:

- *Any students with disabilities who need accommodation in this course are encouraged to speak with the instructor as soon as possible to make appropriate arrangements.*
- *Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders*
- *All work done in this course must be completed in a manner consistent with NDSU University Senate Policy, section 355: Code of Academic Responsibility and Conduct*
(<http://www.ndsu.nodak.edu/policy/355.htm>)