Physics 120 FUNDAMENTALS OF PHYSICS Spring 2024

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Bulletin Description: Application of physics concepts and principles to the real world. Topics selected from mechanics, heat, optics, electricity, and magnetism. Astronomy and modern physics will also be surveyed.

This course has been approved for the General Education category PHYSICAL SCIENCE (SP) category. Students will analyze components and dynamics of natural and physical worlds, develop models to explain phenomena within the natural and physical worlds, and apply methods of scientific inquiry to enhance their understanding of the natural and physical world.

Objectives: The goal of this course is to provide students with the knowledge and understanding of basic physical principles that will aid them in their everyday lives, careers, and personal decision making as scientifically literate and technologically informed members of society. Students attain an appreciation for the impact of science on society and history and for the interplay between experiment and reasoning to describe, explain, and predict physical phenomena. The course creates opportunities to appreciate what humans know about the physical world as well as current frontiers of human knowledge.

Prerequisites: High-school algebra

Meetings: Tuesday and Thursday 3:30pm-4:45pm in *NDSU A.G.Hill building, Rm 112*. This is an in-person course. Class meetings may be recorded and made available through Lon-Capa.

Office hours: Mon 10 am-11am and Fri 11am-12pm in South Engineering room 216A; additional zoom or face-to-face options may be specified during the course.

Textbook: Art Hobson, *Physics: Concepts & Connections*, 5th edition, Pearson, 2010

Topic Outline and Timing: The chapters in the textbook to be discussed in this course are listed below, along with the tentative exam dates.

Chapter 1: Scientific method, early astronomy, and the solar system
Chapter 2: Matter, units, unit conversion
Exam 1 (Ch. 1-2): Tuesday, January 30 (3:30-4:00pm)
Chapter 3: Motion: speed, velocity, acceleration
Chapter 4: Force, Newton's laws of motion
Chapter 5: Gravity, stellar evolution
Exam 2 (Ch. 3-5): Tuesday, February 20 (3:30-4:00pm)
Chapter 6: Work, energy, conservation of energy, power
Chapter 7: Second law of thermodynamics, entropy, energy efficiency
Exam 3 (Ch. 6-7): Thursday, March 14 (3:30-4:00pm)
Chapter 8: Electricity, atomic structure, magnetism
Chapter 9: Waves, electromagnetic radiation, atmospheric issues
Exam 4 (Ch. 8-9): Thursday, April 04 (3:30-4:00pm)
Chapter 10: Special theory of relativity, mass-energy equivalence
Chapter 11: General theory of relativity, cosmology
Exam 5 (Ch. 10-11): Tuesday, April 23 (3:30-4:00pm)
Chapter 12: Introduction to quantum mechanics, quantization of light & matter
Chapter 13: Quantum uncertainty & nonlocality, quantum model of the atom
Chapters 14-17: Selected topics in nuclear & particle physics (time permitting)
Final Exam (comprehensive): Tuesday, May 07 (10:30am-12:30pm)

Format: In-class activities involve some traditional lecture plus discussions with a focus on critical thinking and problem solving. Paper flash cards may be distributed and used. Students are encouraged to engage in in-class discussions and ask questions at any time during or after class. Class announcements will be made through email. Students demonstrate their level of comprehension in LON-CAPA homework and exams.

How to succeed: Attending class, reviewing lecture notes, reading the textbook, taking part in class activities and discussions, and completing homework problems are keys to success. Each student is encouraged to contact the instructor with any concerns, questions, and suggestions. If desired, additional review sessions will be offered at any time during the course, especially prior to exams.

LON-CAPA: This course does not use Blackboard. Instead, the LON-CAPA course management system will be used to post homework, lecture notes, grades, and other information. LON-CAPA can be accessed by selecting the appropriate server at **http://www.ndsu.edu/physics/lon_capa/**. Your username is everything to the left of the @ in your NDSU email address (use all lowercase letters). For example, if your email address is Sheldon.Cooper.2@ndsu.edu, then your LON-CAPA username is sheldon.cooper.2. Initially you create your own password by following the link "Forgot Password". For help using LON-CAPA contact your instructor or laboratory technician Paul Omernik (SE110, Paul.Omernik@ndsu.edu, 231-7047). Technology concerns other than Lon-Capa can be addressed to IT Help Desk; Email: ndsu.helpdesk@ndsu.edu, Call: 701-231-8685 (option 1)

Homework: 6 homework problem sets, each containing a number of problems as specified in the table below, will be assigned via the LON-CAPA online system. The total number of available problems is 150.

set #	coverage	assigned	due	recommended # of problems to be solved	# of problems available
1	chapters 1-2	Jan 09	Jan 30	20	25
2	chapters 3-5	Jan 09	Feb 20	15	25
3	chapters 6-7	Jan 09	March 14	20	23
4	chapters 8-9	Jan 09	April 04	15	27
5	chapters 10-11	Jan 09	April 23	15	27
6	chapters 12-13	Jan 09	May 07	15	23

Each correctly solved problem earns 1 point. For problems with multiple parts each part earns 1 point. To get full credit, 100 points must be earned. The solved problems can come from any of the chapters and can be solved as long as the problems are available (until the due date). You may work together on homework sets, but simply copying another's answers is neither recommended nor beneficial. No late homework will be accepted.

Exams: 6 exams (including the final) will be administered. For each exam (including the final), 10 questions need to be solved within 30 minutes. Each exam covers the material as specified on the preceding page. Each correctly solved problem earns 2 points. The lowest-scoring exam will be dropped. The other 5 exams will count towards the final score. The maximal number of available points from the exams is thus 100.

All exams are "open notes". Notes include the textbook and all course material in Lon-Capa. Using computers to access notes is permitted during an exam. Communicating with others and making use of external help (especially tutoring services) is not permitted. Exams can be taken from any location, including the classroom. Students bring a device (computer, laptop, even a cell phone may work) that allows them to access and answer the exam questions through Lon-Capa during exam time. Scantrons will not be used. No makeup exams will be scheduled.

Grading: Grading will be based on LON-CAPA homework score (max. 100 points) and 5 exams (max. 100 points). From the actual number of points and the maximal number ($100+100=200$ points) the percentage will be calculated and used to grade according to: 88.0% -100% A, 77.0% - 88.0% B, 66.0% - 77.0% C, 55.0% - 66.0% D, 0% - 55.0% F. Expressed in points, this corresponds to: 176 - 200 A, 154 - 175 B, 132 - 153 C, 110 - 131 D, 0 - 109 F. The instructor reserves the right to lower the grade cutoffs in response to class performance, but they will not be raised.

Additional Information:

- Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.
- The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.
- According to NDSU Policy 331.1 (PDF download: https://www.ndsu.edu/fileadmin/policy/333.pdf) attendance is expected.