Physics 120: Fundamentals of Physics

Welcome to PHYS 120, the introductory physics intended for non-science majors. It is an introduction to physics concepts and their relevance to everyday experiences. This course covers mechanics, electricity, conservation laws and some of their applications, and selected topics in other areas of physics that have applications in everyday life. This will be done by introducing the language, ideas and concepts in the above topics.

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Instructor information

***Lecturer*:** Naresh Sen *Office*: South Engineering 3**
Phone: 701-231-8974 *Email* : naresh.sen@ndsu.edu
Office Hours : Tuesday 5:00 pm – 6:00 pm; W 2:00 pm – 3:15 pm
Also, we can make other time arrangements if these times don't work for you.

***graduate assistants (TAs)*:** TBD

Class meeting times:
3:30 – 4:45 pm TTh in Hill 112 (auditorium in STEM building located across from the campus Union)
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Course objectives and goals

Upon completion of this course, you are in a position to:

- apply the ideas of physics to electric and magnetic fields, forces, potentials, electric circuits, and electromagnetic induction
- analyze behavior of systems containing electrical and magnetic components such as conductors, batteries, resistors, capacitors, magnets, motors, etc.
- solve conceptual and quantitative problems involving such systems, *including problems you may not have explicitly seen before but are based on concepts you HAVE seen, worked with in class or outside class, and learned*
- recognize parameters that are relevant physical systems
- make predictions based on physical laws using scientific methods and reasoning
- assess validity of mathematical formulations and solutions in terms of physical system behavior

Some of the tools for being able to reach the above goals are:

- Making connections between different physical concepts
  - combining knowledge acquired in other/previous courses with new content from this course. E.g. previous skill – drawing free-body diagrams (FBDs); new content – electrical forces
  - applying conservation principles – electric charge, energy, etc. to analyze a problem
  - applying techniques of vectors, geometry, calculus, etc. to solve problems. For example: FBD for forces, geometry for force components, calculus for 'what is the maximum of…?'

- Using multiple representations to solve problems
  - visualizing problems by drawing sketches – meaning sketches, diagrams or 'something like that (SLT)' – to get the **physical picture** and determine relevant concepts/ideas for solving the problem
  - obtaining **graphical representations where relevant** to connect with the **physical picture**

Expectations for the course

What you can expect from me
To help you understand concepts of physics and be able to apply them to solve problems, I will endeavor to do the following:

1. To provide as many tools as I can to make the course useful for you.
2. To be available for assistance during office hours or outside office hours, whichever is convenient.
3. To begin and end class on time, and follow as closely as possible (as time allows), the schedule outlined on the course web site.
4. To do my best to promptly respond to your emails.
5. To do my best to have graded assignments and exams returned to you in a timely manner.
6. To make sure exams are fair, and the grading is likewise fair.
7. To listen to comments about my instruction and be open to suggestions.

What I expect from you
While the tools will be provided to help you learn, you still have to do the work and the learning; I cannot do that for you. To give an automotive analogy: Someone can give you a car and show you how to drive, but you still have to do the driving, fill the gas tank, change the oil, check tire pressure to ensure a smooth ride, etc. So you are encouraged to do the following:

1. To make use of the tools provided to you in a manner that is most useful to your way of learning.

2. To ask questions early and often if something is not clear, in class or during office hours. Do not wait till the last minute when there is very little time to address problems and make adjustments to enhance learning the material.

3. To participate in class during discussion of concept questions and in hands-on lab activities.

4. To attend classes regularly, come to class on time and not get up and leave before class ends. This is disruptive to the class in general and your group in particular, especially during clicker questions where you are working with people around you throughout the lecture. If there are reasons for which you need to leave early, you need to let me know in advance.

5. To be willing to make mistakes and have 'false starts' and learn from them rather than give up. Thus you bring a can-do, don't-give-up approach to your learning process.

6. To share your learning and expertise with others in the class, and thereby help to enhance the overall learning experience of the class. Since the grading scheme for the course is on an absolute scale, helping others will not adversely affect your grade.

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The next two pages consist of details of the course material, in-class activities, reading, classroom etiquette, and grading scheme for the course.
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Prerequisites: High school algebra
This course will use arithmetic frequently for quantitatively understanding concepts. We will also be working with graphs and scientific notation. Any other math needed will be discussed as needed before actually using it for conceptual understanding.

COURSE MATERIAL: Textbook, LON-CAPA, clicker

Textbook: *Physics Concepts and Connections* by Art Hobson, 5th edition
Reading assignments will typically specify chapters and sections in the textbook.

LON-CAPA and clickers: Why do we use these?
We generally learn more from our own mistakes than from unqualified successes. Therefore do not be afraid of making mistakes; having a few 'false starts' is an integral part of learning. Being actively engaged in the learning process is one of the main reasons for having the online homework and in-class concept questions using clickers. These allow you to understand concepts and practice solving quantitative problems in a low-stakes environment, and thus prepare for the high-stakes assessment environment (exams).

LON – CAPA online HW
For the online homework, go to https://proteus.physics.ndsu.nodak.edu/adm/roles
You will need to give a username and password. The username is your NDSU email address without the '@ndsu.edu'. Then use the 'Forgot password?' option to set your password.

Online homework (HW) for the course is 20 % of the course grade, which is comparable to the typical percentage for introductory courses in the physics department. Extensive physics education research (PER) data shows that graded online homework with immediate feedback increases student engagement and learning. Time spent on HW is very effective in learning the material, and the high percentage on HW grade rewards this time and effort. Additionally, the 20 % provides a safety net in the event of a lower-than-expected exam performance.

Clickers for in-class concept questions (CQs)
One clicker, an electronic transmitter used for audience feedback during lecture. Purchase your clicker at the bookstore if you don't already have one from having used it in a previous course, and register your clicker online on Blackboard.

In lectures, conceptual questions (CQs) are meant to lead to discussions with your neighbors (groups of 3-4) followed by individual responses via electronic devices ('clickers'). After a question is posited, you discuss the concepts involved with their neighbors, and then respond individually, or 'vote', using your clickers. If the majority of the class (say, 80 %) gives the correct response, the lecture continues. However, if the responses are incorrect or split among several choices, it is immediately clear that more discussion is needed, often followed by a second round of 'voting'. Thus the focus of the lecture is to help you understand concepts via active participation rather than 'covering' material. In this way, the entire class gets to participate throughout the lecture. This is different than a traditional lecture, in which usually the same few students are actively engaged on a regular basis.

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Reading
Reading is an essential part of this course. You are expected to have completed the reading assignments prior to lecture. The material in this course is too difficult to learn just by listening to lectures. Reading assignments on a roughly weekly basis will be posted on Blackboard or announced in class. They will not be graded, but are intended to let you know what to read and prepare ahead of the lecture. During the

lecture, you can then focus on the parts that you have difficulties with during the reading, instead of seeing the material in class for the first time.

Classroom etiquette
Observing etiquette in the classroom is to be considerate to your neighbors and to the class. *Please mute all cell phones when entering any classroom. Cell phone use in class is not acceptable under any circumstances since it distracts your neighbors and disrupts the lecture***.** Please do not surf the web on your laptop or text message during lecture. Please do not throw vegetables at the instructor. It is perfectly OK to interrupt the lecture by yelling "Question!" Questions in lecture are always good.

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Grading scheme

Type of Assignment	**Percentage**
Homework	15%
Lecture participation	5%
Exam (3 @ 18 % each)	54%
Final Exam	26%
Total	100%

Final grades will be assigned on an absolute scale according to your final point total:

90.0% and Above	A
80.0% - 89.9%	B
70.0% - 79.9%	C
60.0% - 69.9%	D
59.9% and Below	F

These grade cuts may be lowered (made easier) but they will not be raised (made harder).
Please see the 'Exams' link on Blackboard for this course for exam schedule and other exam policies.

Having an absolute grading scheme means that you will get a grade based on your performance, and does not depend on how others do in the course. An absolute grading scheme encourages working in groups and helping each other instead of competing with each other. Physics education research shows that learning from others and teaching others in class ('peer instruction') improves understanding and retention of concepts (and so is highly encouraged).

Students with accommodation needs
If you have special needs requiring accommodations to allow you to do the work needed for the course, or some other condition that will require academic accommodations, please notify me in the first two to three weeks of the course. If you are taking exams with the Disability Services Office (DSO), please make appropriate arrangements with DSO, and inform me by email at least 48 hours before each exam.

Academic Honesty: 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

Physics 120: **Physics Concepts and Connections** **Fall 2016**

EXAMS
3 midterm exams: 18% each, total 54%
Final Exam: 26 %

Three midterm exams will be held during regular class time on the dates shown below (which also appear on the weekly schedule link). Final exam will be according to the University final exams schedule. All exams are comprehensive.

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Exam 1: September 22 Thursday of week 5
Exam 2: October 20 Thursday of week 9
Exam 3: November 17 Thursday of week 13

Final exam: December 13 Tuesday at 10:30 am (Exam week as per university schedule)

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All exams are closed-book but you are allowed (encouraged!) to bring a single formula card of size 3.5"x 5" **or smaller** to the exams (typical index card works for this). You may write anything on **one side** of the card, but everything must be handwritten – no typing or photocopying, and no magnifying glass allowed. You should bring a simple (not graphing) calculator and a number 2 pencil for every exam. There will be no sharing of calculators during exams. Cell phones, iphones, notepads, and other communication devices will not be allowed.

There is no make-up for the final exam. There is also no alternate time for the final exam.

		Fall 2016 Phys 120 weekly schedule (week 5 onwards)	
	date	**lecture topic**	**textbook chp/sec**
week 5	20-Sep	Newton 2, gravity	ch4: 3, 4
	22-Sep	EXAM 1	
week 6	27-Sep	friction, Newton 3, momentum	ch4: 5 ,6, 7
	29-Sep	universal gravitation; Work & energy	ch5: 1, 2; ch6: 1,2
week 7	4-Oct	kinetic, potential & thermal energy; energy conservation	ch6: 4, 5
	6-Oct	energy conservation & transformation; energy rate/power	ch6: 6, 7
week 8	11-Oct	Heating, heat engines	ch7: 1, 2
	13-Oct	Electric force, electric atom	ch8: 1, 2
week 9	18-Oct	Force fields: gravitational, electric, magnetic	ch8: 5, 6
	20-Oct	**EXAM 2**	
week 10	25-Oct	Waves: rope-like & slinky-like; wave interference	ch9: 1, 2
	27-Oct	Waves: light waves (EM waves), light spectrum	ch9: 4, 5, 6, 7
week 11	1-Nov	Relativity	ch10
	3-Nov	Relativity	ch10
week 12	8-Nov	Nucleus of atom: atomic forces and structure	ch14: 1, 2
	10-Nov	Atoms: Radioactive decay, radioactive dating	ch14: 3, 4
week 13	15-Nov	Nuclear chain reactions: fission ($E = mc^2$), fusion	ch15
	17-Nov	**EXAM 3**	
week 14	22-Nov	To be decided (TBD)	
	24-Nov	HOLIDAY	
week 15	29-Nov	TBD	
	1-Dec	TBD	
week 15		DEAD WEEK	
week 16		final exams week	