PHYS 111 – Honors Mechanics (with Lab), Fall 2017

Course meets: MWF, 9:00-9:50am, Herzstein 212

Instructor: Professor Anthony Chan, aac@rice.edu
Office: 308 Herman Brown Hall
Phone: 713-348-2531
Office Hours: Friday 1:30-3:30pm.

Format: "Traditional" lectures and problem sets, plus exams and labs. I encourage *questions* – please feel free to ask questions during the lectures.

Laboratories: Professor Stanley A. Dodds, dodds@rice.edu
Office: 215 Herzstein Hall
Phone: 713-348-2510

Instructor for the Help Sessions: Visiting Professor Satya Nandi, s.nandi@okstate.edu

Main Text: Kleppner and Kolenkow, *An Introduction to Mechanics*, second edition, Cambridge University Press (2014). See the Rice Bookstore and/or Amazon.com. As described in the preface of the textbook, this course is "intended for students who seek to understand physics more deeply than the usual freshman level." This textbook is used at MIT, Princeton, and the University of Chicago.

Web Page: Login to canvas.rice.edu

General Information: This 4-credit-hour course covers content similar to PHYS 101, but the book and course assume particularly well-motivated and well-prepared students. We will cover some additional material, and certain topics will be explored in greater depth. There will be more of an emphasis on homework and a somewhat higher workload, and the midterm exams will be "take-home" tests. The final exam will be a scheduled in-room exam. A ***prerequisite*** for this course is knowledge of differential and integral calculus, equivalent to MATH 101 and 102, or a high score on the Calculus BC advanced placement (AP) exam. Students with a strong high school background in physics and math are encouraged to take 111, particularly if they might want to major in physics or a closely related field. *If you are considering switching from PHYS 111 to PHYS 101 try to decide ASAP (within a week or so).*

Why Mechanics? A course in mechanics is typically the first course in the undergraduate physics curriculum, and serves as a foundation course for the physics and astronomy majors as well as much of engineering. Concepts of "classical" mechanics include vectors, kinematics (the mathematical description of motion), dynamics (forces and Newton's laws), kinetic and potential energy, momentum, angular momentum, rotational motion, Newtonian gravity, and special relativity. Along the way you will see some multivariable calculus and some (simple) differential equations, from the physics point of view.

Homework: When there are not exams, there will be (approximately) weekly problem sets, assigned Wednesday and due the following Wednesday. These problem sets must be done ***under the Honor System***, subject to the following:

- You may discuss problems with each other, but written solutions must be your own work and must not copied from any other source.
- Solutions from previous years may not be consulted.
- Homework should be turned in to the mailbox labeled "PHYS 111" opposite 304 Herman Brown Hall by 5:00 pm on the due date. Late homework will be penalized 15% per day unless excused by illness or some other instructor-approved reason. Late homework should be turned in to ***Anthony Chan***, not the homework mailbox! Graded homework papers will be returned in class.
- Numerous resources are available for physics-problem-solving help online. These sites can be reasonable tools when seeking additional examples of problems or trying to learn difficult concepts. However, these sites are ***not permitted*** for use on these homework assignments or exams. We are aware of many of these sites and monitor them for PHYS 111 course content. Don't do this.
- Help sessions will take place weekly for each problem set. These are tentatively scheduled for Friday at 4:15pm and Monday 3:00pm-5:00pm, in Herzstein 212. These are an opportunity to get together with classmates and work collaboratively to understand the material.
- When I compute final grades, I will drop your lowest homework score.

Working hard on the problems is the best way to learn this material. Your textbook provides some worked examples, and I will do some in class, but actually thinking about, setting up, and solving problems yourself is the best way to become proficient.

Exams: At the moment, I am planning that the midterm exams will be timed take-home exams. You may use the textbook (K&K), your class lecture notes, and a formula sheet written by you. The exams will be made available via the department office in Brockman Hall during the specified exam periods. You may ***not*** collaborate with other students on the exam, or use other resources (e.g., the web). Previous years exams may not be consulted unless I place them on the course webpage. Midterm exams are tentatively scheduled for Wed. September 27 to Wed. October 4 and Wed. November 1 to Wed. November 8. The final exam is scheduled by the Registrar, not me, some time in the final exam period (Wed. December 6 to Wed. December 13).

Laboratories: The PHYS 111 lab will be run by Prof. Dodds. It will have flexible hours and include six experiments. More information on the laboratory is available on the course website.

Make-ups and excused days: Make-ups for missed homeworks, exams, or laboratories will be at the discretion of the instructor. If you have university business or a conflicting class, notify us well beforehand, in writing. If you have a serious reason beyond your control (for example: your own illness, or a death in the family), notify the instructor as soon as possible in writing or by email.

Grading:

Exam 1:	20%
Exam 2:	20%
Final:	25%
HW:	25%
Lab:	10%

The course is graded such that I set the *mean* overall grade at the end of the semester at the dividing line between B and B+. If you want to think about grades on individual exams, the same is true. This is generally different than the old 90%+ = A scale. To give you a sense of the numbers, in recent years the mean overall final grade was typically close to a 79, and the grade breakdown was typically 95+ = A+; 90-95 = A; 85-90 = A-; 79-85 = B+; 74-79 = B, etc. As mentioned above, when I compute final grades I will drop your lowest homework score.

Other resources: Here are brief descriptions of some alternate books and websites.

- Kittel, Knight, and Ruderman, *Mechanics (Berkeley Physics Course Vol. 1)*. This is similar to K&K. It was written in the early 1970s as part of a curriculum development effort by the University of California at Berkeley. It's out of print, but used copies are around, and it's pretty good (though dated in places).
- Feynman, Leighton, and Sands, *The Feynman Lectures on Physics, Vol. 1*. This is the first volume of the famous 3-volume set, derived from Feynman's 1st year physics course at Cal Tech. The official website is also very useful, with problems and a forum.
- Serwey and Jewett, Physics for Scientists and Engineers. This is the book for PHYS 101. The book's great strength is a large number of problems with a broad distribution in difficulty. The electricity and magnetism part of this is used for PHYS 102. I believe you can buy just the mechanics and E&M parts of the book separately.
- Fishbane, Gasiorowicz, and Thornton, *Physics for Scientists and Engineers*. This is very much like S&J, with lots of example problems. Broad, not too deep.
- Halliday, Resnick, and Walker, *Fundamentals of Physics*. Also like S&J. Broad, not too deep.
- Walter Lewin's old MIT lectures from Physics I.
- Yale's Physics I course - youtube lectures. Also very good.
- Physics applets. A list of links to relevant physics applets and flash animations. Good for getting some physical intuition.

Students with Disabilities: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with the instructor during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities are encouraged to also contact Disability Support Services in the Allen Center (e-mail: adarice@rice.edu, phone: 713-348-5841) during the first two weeks of class so that timely and appropriate arrangements may be made.

Tentative Schedule

Note: This will be updated during the course of the semester.

	Week of	K&K Reading	Problem Sets & Exams	Topics
1	Aug 21	1.1-1.7, 1.10, 1.11, 2.7, 2.8	PS 1, due Wed Aug 30	Vectors, units, and coordinates
2	Aug 28	1.8, 1.9, 2.1-2.6, 2.9*, 2.10*, 3.4.4	PS 2, due Thu Sep 7	Kinematics, Newton's laws
3[1]	Sep 4	2.9, 2.10	PS 3, due Wed Sep 13	More Newton's laws, friction, circular motion
4	Sep 11	3.1-3.7	PS 4, due Wed Sep 20	Drag, springs, harmonic motion
5	Sep 18	4.1-4.10	PS 5, due Wed Sep 27	Linear momentum, impulse
6	Sep 26	9.1-9.5	**Exam 1**, due Wed Oct 4	Rocket eq, frames of reference, pseudoforces
7	Oct 2	5.1-5.8, 5.10, 5.11	PS 6, due Thu Oct 12	Kinetic energy, work, potential energy, conservation of mechanical energy
8[1]	Oct 9	6.1-6.3, 6.5	PS 7, due Wed Oct 18	Energy diagrams, stability, and collisions
9	Oct 16	7.1-7.6	PS 8, due Wed Oct 25	Rotational motion, angular momentum
10	Oct 23	7.7, 7.8, 8.1-8.6	PS 9, due Wed Nov 1	More angular momentum, gyroscope
11	Oct 30	10.1-10.6, 11.1-11.2	**Exam 2**, due Wed Nov 8	Central force motion, the harmonic oscillator revisited
12	Nov 6	11.3-11.6, 12.1-12.4	PS 10, due Wed Nov 15	More on harmonic oscillators, special relativity
13	Nov 13	12.5-12.11	PS 11, due Wed Nov 29	Special relativity
14[1]	Nov 20	Ch. 13		Special relativity
15	Nov 27	Ch. 14		Special relativity + wrap-up

[1] These weeks have two lectures.

* Regarding sections 2.9 and 2.10: The first time through, skim the Examples; the second time, work the Examples yourself.

Reading: The K&K Reading is very important. Ideally, try to complete the K&K Reading *before* the Topics are covered in lectures. If you cannot do that, make sure you have completed it before you attempt the Problem Set assigned that week. Note that material in the K&K Reading may appear in the Problem Sets and Exams, even if it has not been covered in lectures. Finally, although they are not listed in the above table, the "Notes" at the end of many of the chapters of K&K are very valuable so please read those too.

Workload: Plan to work, on average, approximately 3 hours per week per credit hour on the course, outside lectures, including the labs. That is, 3x4=12 hours per week. (This "3 hours of work per credit hour per week" is a good rule-of-thumb for planning your time.)

Updated: August 20, 2017