PHYS 111: Honors Mechanics (with Lab) Fall 2019 Syllabus

Course Lectures: MWF, 10:00-10:50am, Herman Brown Hall 227

Instructor: Professor Anthony Chan, aac@rice.edu
Office: 308 Herman Brown Hall; Phone: 713-348-2531
Office Hours: Friday 2:00-3:30pm

Format: Lectures and problem sets, plus exams and labs. I encourage *questions*, especially if something is unclear – please feel free to speak up during the lectures.

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

Help Session Teaching Assistant: Mathieu Simeral (graduate student), mathieu.l.simeral@rice.edu

Main Text: Kleppner and Kolenkow (K&K), *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 has been used at MIT, the University of Chicago, and Princeton.

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-prepared and well-motivated students. Such students are encouraged to take PHYS 111, particularly if they might want to major in physics or a closely related field. We will cover some additional material to PHYS 101, and certain topics will be explored in greater depth. There will be more of an emphasis on derivations and on homework, and a somewhat higher workload. A prerequisite for this course is knowledge of differential and integral calculus equivalent to MATH 101 and 102 (as indicated, for example, by a score of 4 or preferably 5 on the AP Calculus BC exam). AP Physics, with or without calculus, is preferred but not required. ***If you are considering switching from PHYS 111 to PHYS 101 I strongly recommend deciding as soon as possible; ideally within the first two weeks of the semester.***

Why Mechanics? A course in classical 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 science and engineering. Concepts of classical mechanics in this class include vectors, kinematics (the mathematical description of motion without reference to forces), Newton's laws, dynamics (the mathematical description of motion with reference to forces), kinetic energy, potential energy, momentum, angular momentum, rotational motion, Newtonian gravity, harmonic oscillators, and special relativity. Along the way I will teach a small amount of mathematics beyond the MATH 101/102 level, including some multivariable calculus, differential equations, and complex variables, but only at an introductory physics-based level.

Problem Sets: When there are not exams, there will be weekly problem sets, usually assigned on 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 ***you must write up your solutions on your own*** and you must not copy solutions from any other source.
- Solutions from previous years must not be consulted.
- 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 the specific problems in the problem sets. (Basically, do not try to find an exact solution for a PHYS 111 problem online.)
- 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 (or part of a day) unless excused by Professor Chan. All late homework must be labeled with the turn-in time and date. To make a request to excuse the late penalty, email Professor Chan stating the problem set number, the turn-in time and date, and the reason for your request.
- Graded homework papers will be returned in class.
- When I compute final grades, I will drop your lowest homework score.

Working hard on the problems is the best way to learn the material. The 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. Typically, completion of a problem set involves material from the lectures, the textbook, and the help sessions, and a substantial amount of time and effort. Please, ***do not*** look at solutions from previous years – as well as being an Honor Code violation, you would be less well prepared for future problems (including exam problems!), compared to solving them yourself.

Help Sessions: These will take place weekly for each problem set. They are scheduled for Fridays 4:00-5:30pm, and Mondays 3:00pm-5:00pm, except on the first day of classes and on Rice holidays. The Help Sessions will be held in rooms to-be-determined by the Registrar. The Help Sessions are an opportunity to get together with classmates and the Help Session teaching assistant, to work collaboratively to understand the material. The Help Sessions are a bridge between the PHYS 111 lectures (which emphasize basic concepts and important derivations) and the Problem Sets (which emphasize *applications* of the lecture material and provide practice in solving problems). Some of the problems are designed to be quite challenging, so please take advantage of the Help Sessions! Put another way: ***Please, Just Go To The Help Sessions!***

Exams: The two "midterm" exams will be timed take-home exams; they will be made available from the department office in Brockman Hall during the specified exam periods — see the Tentative Schedule on page 4 — there is usually a one-week Thursday-to-Wednesday period for exam pickup, excluding Saturday and Sunday, and the exam must be returned to the department office the same day. The final exam is an in-class exam scheduled by the Registrar (not me) sometime in the final exam period. In all the exams you may use the textbook (K&K) and a formula sheet written by you. You must ***not*** collaborate with other students on the exams, or use any non-allowed resources (e.g., the web). ***Previous years' exams must not be consulted (unless I make them available on the course website).***

Laboratories: The laboratory part of PHYS 111 will be run exclusively by Professor Dodds. It will have flexible hours and include six experiments. More information on the labs is available on the course website. Questions and comments about the labs should be directed to Professor Dodds.

Make-ups: Make-ups for missed problem sets, exams, or laboratories will be at the discretion of the appropriate instructor (Professor Chan for problems sets and exams; Professor Dodds for labs). If you have university business or a conflicting class, notify us well beforehand, by email. If you have a serious reason beyond your control (for example: your own illness, or a death in the family), notify an instructor as soon as possible by email.

Missed lectures: If you miss a lecture (or a small number of lectures) there is no need to notify the instructor; just get a copy of the missed material from a classmate. Please note that the lectures are very important for the class -- there are things in the lectures that are not in the book.

Grading:

Exam 1:	20%
Exam 2:	20%
Final:	25%
Problem Sets:	25%
Labs:	10%

The course is graded such that I usually set the mean or median overall grade near the dividing line between B and B+. This is generally different from the "90%+ = A" scale. To give you a sense of the numbers, in recent years the mean overall grade was typically close to 80%, and the grade breakdown was typically 95+ = A+; 90+ to 95 = A; 85+ to 90 = A-; 80+ to 85 = B+; 75+ to 80 = 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 relevant 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.
- Serwey and Jewett, Physics for Scientists and Engineers. This book has been used 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 has been used for PHYS 102. I believe you can obtain the mechanics and E&M parts of the book separately.
- Fishbane, Gasiorowicz, and Thornton, *Physics for Scientists and Engineers*. This is very much like Serwey and Jewett, with lots of example problems. Broad, not too deep.
- Halliday, Resnick, and Walker, *Fundamentals of Physics*. Also like Serwey and Jewett. Broad, but not especially deep.
- 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.

Tentative Schedule *(This will be updated during the semester.)*

	Week of	K&K Reading/Working	Problem Sets & Exams	Lecture Topics
1	Aug 26	1.1-1.11, 2.7, 2.8		Orientation, units, vectors, coordinates
2*	Sep 2	2.1-2.6, 2.9, 2.10	PS 1 due	Kinematics, Newton's laws, inertial frames
3	Sep 9	3.1-3.4	PS 2 due	Constant force, centripetal force, ropes
4	Sep 16	3.5-3.7	PS 3 due	Pulleys, drag, spring force, gravity, momentum
5	Sep 23	4.1-4.10	PS 4 due	Systems of *N* particles, center of mass
6	Sep 30	9.1-9.5	**Exam 1 due**	Rockets, pseudo-forces, rotating frames
7	Oct 7	5.1-5.8, 5.10, 5.11	PS 5 due	Coriolis force, conservation of energy
8*	Oct 14	6.1-6.3, 6.5	PS 6 due	Energy diagrams, stability, and collisions
9	Oct 21	7.1-7.6	PS 7 due	Rotational motion, angular momentum
10	Oct 28	7.7, 7.8, 8.1-8.6	PS 8 due	Rigid body motion
11	Nov 4	10.1-10.6, 11.1-11.2	**Exam 2 due**	Central force motion
12	Nov 11	11.3-11.6, 12.1-12.4	PS 9 due	Harmonic oscillators
13	Nov 18	12.5-12.11	PS 10 due	Special relativity
14*	Nov 25	Ch. 13	PS 11 due	Special relativity
15	Dec 2	Ch. 14		Special relativity + wrap-up

***** *These weeks have only two lectures.*

K&K Reading/Working: The weekly K&K Reading/Working (which means self-guided reading, summarizing, and working the equations and examples in K&K) is ***very important***. Except for day 1 of week 1, you are expected to complete the K&K Reading/Working for each week, ***before that week begins,*** so that when I cover those topics in lectures I will assume you have read the relevant sections in the textbook. Note that, in some (relatively rare) cases, material in K&K 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/work 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 for PHYS 111. (This "3 hours of work per credit hour per week" is a good rule-of-thumb for planning your time for other courses too.)

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.

Updated: 24 August 2019