PHY 4222 Mechanics 2

Spring 2021 course syllabus

(1/08/20 Typos corrected on page 4.)

Instructor:	Yasu Takano, NPB 2356, 392-9326 (email: takano AT phys dot ufl dot edu)
Time and delivery:	M W F Period 3 (9:35 AM −10:25AM), via Zoom
Textbook:	John R. Taylor, *Classical Mechanics* (University Science Books, 2005)
Prerequisites:	PHY 2048 (Physics 1 with calculus) or equivalent, and PHY 3221 (Mechanics 1) or equivalent
Office hours:	Read the sections entitled Tutorials and also Office Hours

Synopsis

The second part of the two-semester standard undergraduate-level classical mechanics, this course covers two-body central-force problems (think of the orbits of planets and comets around the Sun), mechanics in nonlinear frames (where fictitious forces such as the centrifugal force and the Coriolis force are useful), rotational motion of rigid bodies (for instance a spinning top whose axis is tilted or a wobbly Frisbee tossed by a beginner), coupled oscillators and normal modes, nonlinear mechanics and chaos, the Hamiltonian mechanics, and collision theory. These are subjects of Chapters 8 − 14 of Taylor. Not covered are Chapters 15 and 16 of the book, on the special relativity—on which Griffiths' Introduction to Electrodynamics does a better job—and continuum mechanics.

The mathematics required for this course is mostly ordinary differential equations and linear algebra.

Your goal

By completing this course, students will become able to and gain deeper understanding of some of the general principles in physics—symmetries and conservation laws. Quantitatively, your goal in this course is to become able to solve most of two-star problems and some three-star problems at the end of each chapter of the book. Those are pedagogically good problems, not run-of-a-mill problems that can be solved by following a recipe. In fact, as you know, you do not learn college-level physics by memorizing recipes and applying them to problems. You cannot skip the important step of thinking when you do problems. Pedagogical problems force you to think—by design. More on this under **How to Study**.

Lectures

As you must have learned by now, lectures in upper-level physics are not meant to spoon-feed recipes for solving problems, nor are the exams in those courses meant for you to apply those recipes. Lectures are intended to help you develop critical thinking, learn the habit of using math as a tool to develop conceptual understanding, and learn by doing problems yourself. In this course, the majority of problems in the book which you aim to become able to solve cannot be solved by simply applying memorized recipes.

For these reasons, lectures assume that you have read the corresponding part of the textbook. Derivations are often relegated to the textbook, allowing the lectures to focus more on understanding results and examples. During lectures, multiple-choice quizzes are given as Zoom polls to motivate discussions and to check your understanding. There are no penalties for wrong answers.

Lectures are delivered primarily by writing on PowerPoint slides as a substitute for a chalk board. All lectures will be recorded in Zoom and made available on UF OneDrive via a link in Canvas. To protect

your privacy, the recordings will be made accessible only to those who are registered for this course and will be deleted from OneDrive after Exam 3. In lieu of lecture notes, PowerPoint slides used in lectures will be posted, in Canvas, under Files.

Tutorials

In the online format, lectures will have to be delivered at a slower pace than usual, leaving little room to do long problems. This deficiency will be remedied by providing weekly tutorials, akin to discussions in introductory physics. They are optional, not required. A typical tutorial will discuss one or two two-star end-of-chapter problems from the list of recommended problems. The tutorials will be recorded for –in the parlance of customer services--quality-assurance purposes, but each video will also be made accessible, if and only if no attendant objects, to those who have attended the particular tutorial and those who were unable to attend because of a legitimate conflict.

Each student will be assigned to one of four tutorial slots per week, each slot accommodating up to seven students. There will be no tutorials during the weeks in which Chapter 12 is covered. This is because nearly all good problems in that chapter are meant to be solved numerically.

How to Study

As you already know, physics cannot be studied without doing problems. The primary purpose of doing problems is to acquire conceptual understanding of the subject and to develop intuition on the behavior of physical systems. There are a correct way and wrong way of doing problems. The correct way comprises five components: (1) to expect the result before embarking on calculation, (2) to keep track of information content as you manipulate equations, (3) to examine the result for correct dimensions and symmetry, and to check whether it agrees with simple/obvious/known results for special cases (e.g. the limit in which one of the independent variables becomes infinite or zero), and (5) to compare the result with what you have expected and, if your expectation has turned out to be wrong, to correct the wrong intuition that has led to the wrong expectation. Of these, 1 and 5 are the keys to developing intuition. What is the wrong way of doing problems? It is what I call “black-box shaking”—putting equations in a figurative box and shaking it until a solution pops out.

You are expected to do all Examples in the book and all recommended problems, a list of which will be provided with each homework assignment. Some of them may require first doing an easier, one-star problem. Homework problems are intended to supplement recommended problems, not to replace them. They, as well as exams, will assume that you have done recommended problems. Without doing recommended problems, you will not do well in the exams.

When doing problems, it is critically important that you first make a genuine effort to solve them by yourself. When stuck, discuss with other students or seek help from the instructor.

Student Solution Manual

A solution manual was published last summer for all odd-numbered problems in the book, available only directly from the publisher: https://www.uscibooks.com/. Price: $34 softcover, $25 eBook.

As you know, solution manuals are not for students who may be tempted to look at solutions without attempting to do the problems themselves. But for those who put in a genuine effort and then get stuck, solution manuals can be useful.

Homework

There will be 7 homework assignments, each roughly corresponding to one chapter of the book. All homework assignments weigh the same, although they may not contain the same number of problems, typically about 8 problems. In some homework assignments, a few problems may not be graded.

Homework must represent your own work. Collaboration with other students are strongly encouraged (read **Zoom** below for how to set up Zoom meetings with your classmates) , but the work you turn in must not be a copy of solutions by others. If the work shows a sign of copying a solution, a zero will be given for that particular problem. Homework must be written neatly, with words and sentences provided to make your solutions understandable and the final results clearly marked as such. Points will be deducted if your solutions are hard to read or hard to understand. Points will also be taken away if your homework shows a sign of "black-box shaking"—such as circular arguments and undirected manipulation of equations—or your result lacks required symmetry or is dimensionally incorrect. There will be no penalties for errors arising from typos that cannot be detected by symmetry and dimension checks.

Homework must be uploaded as a single pdf file to Canvas before 1:00 pm on the due date. No other way of submitting homework is allowed. No late work is accepted, since solutions to the assigned problems will be posted in Canvas on the due date, immediately after 1:00 pm. No make-up assignment will be given for a missed homework. Graded homework will be returned to students via Canvas usually within one week after the due date.

Exams

There will be 3 two-hour exams via Honorlock. Each exam will have three problems, each with a few parts. They will be closed book, closed note, with formula sheets posted in Canvas before each exam and provided in the exam. You will not be allowed to use your own formula sheets, nor a calculator (there will be no numerical questions). Exam 1 will cover Chapters 8 and 9, Exam 2 Chapters 10 and 11, and Exam 3 Chapters 13 and 14. Exam 3 will not be comprehensive. Problems from Chapter 12 will be only in a homework assignment, not in an exam. The dates and times of Exams 1 and 2 given on the Course Schedule are tentative and subject to change, whereas the date and time of Exam 3—Monday, April 26, 10:00 am to 12:00 pm—are fixed, as assigned by the Registrar. For an exam missed for an excusable reason with a verifiable supporting document, a makeup exam will be provided, but only if the student contacts the instructor before the exam or—in case of unexpected emergency—within one week after the exam .

You will do well in exams only if you do all recommended problems and homework problems. Turning in homework by copying solutions without understanding them will not lead to a good grade.

Grading

Grades will be based 60% on exams, 30% on homework, and 10% on lecture attendance. There will be 3 exams, each worth 20% of the grade. All homework assignments weigh the same, although the number of problems may vary from assignment to assignment. Instead of dropping the lowest homework score, as I would normally do, I will make every homework worth 5% of the grade. This is equivalent, if you will, to giving you extra credit for your homework of the lowest score. No exam score will be dropped. For class attendance, 86%—36 lectures, including pre-exam reviews, out of 42—and above will qualify for full credit. If less than 86%, your attendance score will be prorated accordingly.

Students who have received an A in PHY3221 will automatically get the full score of 10% for lecture attendance, since such students may be able to master the course material by reading the book and doing problems, without attending every lecture. This of course depends on the student's study habit. Regardless of their study habits, however, all students are advised to attend the lectures for Chapter 11, on coupled oscillators and normal modes, which will deviate much from the book in favor of what I call the method of equivalent oscillators. In addition, even if you did not receive an A in PHY3221, yet if your total exam score for PHY422 turns out to be 50% or higher out of 80%, you will also receive the full 10% for lecture attendance.

The lower threshold of each letter grade will be as follows.

A 85%

A- 80%
B+ 75%
B 70%
B- 65%
C+ 60%
C 55%
C- 50%
D+ 45%
D 40%
D- 35%
E less than 35%

For most majors, the lowest passing grade is C.

Announcements

All announcements are made in Canvas, which will automatically send you an email. Five most recent announcements will be visible on the course homepage, and all announcements will be archived in Canvas, under Announcements.

Office Hours

The weekly tutorials are in lieu of scheduled weekly office hours. Additionally. an office hour for individual assistance and consultation will be set up on request, by email sent to takano at phys dot ufl dot edu from your GatorNet account.

Zoom

Zoom meetings for lectures start with your microphone muted by default. When you ask a question or give a comment, un-mute yourself temporarily by pressing the space bar on your keyboard. Releasing the space bar will automatically mute your mic, so that you do not have to remember to click the mute icon. Tutorials and office hours start with your mic on.

Zoom's chat is a great tool for communicating with other students during lectures, but not with the lecturer. If you have a question or a comment, use your mic and interrupt me, not via chat or by a raised hand.

Lectures are recorded. To protect your privacy, the recordings are made accessible only on UF OneDrive via a link in Canvas and only to students who are registered for this course. They will be deleted from OneDrive after Exam 3. All parts that are recorded before a lecture starts at 9:35 am and after it ends at 10:25 am will be deleted before posting.

Tutorials will be recorded primarily for the instructor's review. However, each video will be made accessible to the attendants and those who missed the tutorial for a legitimate reason.

Office hours are not recorded.

Students who participate with their camera on or use a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your video or profile image recorded, be sure to keep your camera turned off and do not use a profile image. Students who participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you are allowed to communicate via Zoom's chat, but you must first get my attention by orally interrupting me. The chat is not recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

The URLs, meeting IDs, and passwords for all Zoom meeting will change every seven weeks. For this reason, you are advised to join lectures and tutorials via Canvas, instead of directly via Zoom.

Studying with other students is one good way to learn physics. To set up a Zoom study group, read instructions in Canvas > Files > How-Students-Meet-with-Each-Other-via-Zoom.pdf.

How to Contact the Instructor
To contact me, always send an email to takano at phys dot ufl dot edu from your GatorNet account, with the word "PHY4222" included in the subject line. Do not contact me via Canvas "features" such as Help > Ask Your Instructor a Question. I will ignore all messages sent from Canvas because my very secure email client—I do not use Outlook—will not allow me to directly respond to them. I will also ignore emails that are sent from non-GatorNet accounts such as, gasp, a Gmail account.

Additional Information
Requirements for lecture attendance, exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx.

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://disability.ufl.edu) by providing appropriate documentation. Once registered, students will receive an Accommodation Letter, from the Center, which must be forwarded to the instructor within the first two weeks of the semester.

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://gatorevals.aa.ufl.edu/students/. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://gatorevals.aa.ufl.edu/public-results/.

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. You are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

Campus Resources
Canvas technical support: http://helpdesk.ufl.edu/, 352-392-4357, helpdesk@ufl.edu.

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit https://umatter.ufl.edu to refer or report a concern and a team member will reach out to the student.

Counseling and Wellness Center: https://www.counseling.ufl.edu, 352-392-1575.

Student Health Care Center: https://shcc.ufl.edu, 352-392-1161 (a 24/7 number).

University Police Department: https://police.ufl.edu/, 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: https://ufhealth.org/emergency-room-trauma-center. For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608.

Student Complaints On-Campus: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code.

On-Line Students Complaints: https://distance.ufl.edu/getting-help/student-complaint-process/.

Career Connections Center: https://career.ufl.edu. Reitz Union Suite 1300, 352-392-1601.