

# PHYS 311: Classical Mechanics I, Fall 2021

University of Tennessee, Knoxville  
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Welcome to PHYS 311! This is one of my favorite classes and is a real foundational course in your undergraduate physics education. I have the privilege of introducing you to some of the most elegant techniques in the field, and help you move away from “first-year” physics and into more sophisticated methods.

## Course Information

**Meeting Schedule:** M 9:15-11:10 (Nielsen 207), W 9:15-10:05 (Nielsen 306) [3 Credit Hours]

**Careful! Canvas doesn't list Wed in your schedule!**

**Office Hours:** M 3:30-4:30 over Zoom (See Canvas) [Please contact in case you'd like to schedule a meeting at another time]

**Teaching Assistant:** TBA

**Course Description:** We will consider the topic of advanced classical mechanics. This will mean the study of how things move classically (here, meaning non-quantum-mechanically). Topics covered in this two-semester track (311+312) include single particle motion, systems of particles, oscillations, motion in the presence of forces, two-body and planetary motion, non-inertial reference frames, rigid bodies, Lagrangian and Hamiltonian mechanics, non-linear dynamics, chaos, and the special theory of relativity. The more advanced topics listed here will be covered in the second semester PHYS 312. Detailed course descriptions are available from the department: <http://www.phys.utk.edu/about/course-descriptions.html>

**Prerequisites:** PHYS 136 or 138; CS 102. Familiarity with calculus and basic linear algebra. Familiarity with introductory programming.

## Textbooks

**Primary:** John Taylor, *Classical Mechanics* (189138922X)

**Useful supplement:** Anders Malthe-Sørensen, *Elementary Mechanics using Python* (9783319386843)  
Freely available online from UT Library, [Link]

**Additional resources** via Canvas (May include PDFs, YouTube videos, LinkedIn Learning courses, etc)

**Problem Sets:** Most weeks will have a problem set intended for home. This will involve some combination of programming tasks as well as traditional pencil-on-paper solutions. The primary way to submit these assignments will be via Canvas, with scans of any hand-written solutions. *These will typically be due at 11:59pm (local Knoxville time) on Tuesdays.*

**Exams and Quizzes:** There will be a single midterm exam, and a final exam at the end of the semester. There will be unannounced quizzes most weeks. Quizzes will be multiple choice and administered via clicker.

**Reading Assignments:** Reading the text is a necessary part of learning the material. I ask that you take notes as you read, and submit a picture (phone camera is fine) or copy of your notes on Canvas as an assignment. Any reasonable set of notes will receive full credit. *These will typically be due at 11:59pm (local Knoxville time) on Tuesdays.*

**Grading Policy:** Tentative grade boundaries are A [93,100], A- [90,93), B+ [87,90), B [83,87), B- [80,83), C+ [77,80), C [73,77), C- [70,73), D+ [67,70), D [63,67), D- [60,63), F[0,60). Final grade boundaries will be informed by class grade distributions *when it would be favorable to the grades*. The composition of the final course grade will be as follows:

30%	Problem Sets
20%	Midterm Exam
20%	Final Exam
20%	Studio Work
5%	In-class Quizzes
5%	Reading Notes

**Extra Credit:** There will be multiple ways to earn extra credit that should play to your different strengths. These may be more challenging written problems, more challenging programming tasks in the problem sets or in the studio sessions, contributing significantly to discussions on Canvas, or completing supplementary online courses to grow your skillset. Depending on the task, they will contribute to different portions of above categories. The specifics of these tasks will be defined on Canvas.

**Course Structure:** This course will be taught in two modes. On Wednesdays, we will meet in a conventional classroom environment where a relatively short lecture is meant to summarize those topics primarily learned in the reading. Students are expected to have read the reading assignment and taken notes as described above. On Mondays, we will meet in a computer lab setup for the *studio* portion of the class where the primary focus is on interactive python notebook activities. In the event that a modality change is needed, this will be communicated.

**Computing:** Computing is an essential part of modern physics study and this course. Students will be required to create an account on the university's **ISAAC** (formerly ACF) system. Clicker questions will be administered via the **Turning** system, so students will additionally be required to create an account at [account.turningtechnologies.com](http://account.turningtechnologies.com) using their UT email address.

**Attendance:** Regular attendance is essential and expected. **See COVID-19 Policies below.**

**Communication:** Start any email subject with **[PHYS 311]**. Students are expected to use their UTK email and are expected to check it regularly. Questions of general interest should be asked in the discussion forum, not via private emails to the instructor. Only questions particular to an individual student should be made via email.

**Collaboration and Academic Integrity:** An effective physics education, just like physics research, is impossible without collaboration, so it is essential that you work together with your classmates in person (if that makes sense for you), over Zoom, via online discussion forums in Canvas, or however leads to the most understanding of the material possible. Every student is still expected to complete the assignments in their own voice, implementation, and instance. Purely copied work, plagiarism, or joint solutions will be considered a violation of the academic integrity policy. If I judge that you have copied other sources (from the internet, classmates, or otherwise) or that you have aided others in plagiarizing your work, you will receive zero credit for the assignment or test and your final course grade will be reduced by a full letter grade. A second offense will lead to automatic failure for the course and a report to the Dean of Students. Work with your peers to increase your own understanding of the material.

**Campus Syllabus:** The University's *Campus Syllabus* applies at all times.

**Students w/ Disabilities:** Any student who may need an accommodation based on the impact of a disability should contact Student Disability Services in Dunford Hall at 865-974-6087 to coordinate reasonable academic accommodations.

**Personal Pronouns:** Students are welcome to inform me preferred names and pronouns at any time. I will do my best to address and refer to all students accordingly and support classmates in doing so as well.

### **Tentative Schedule**

*n.b. Class will meet on all days in parentheses below unless otherwise announced. Reading assignments are listed in square brackets.*

Week 1	(Aug 18)	Introduction, essential math, Newton's laws	[Syll., Taylor §1.1-1.5]
Week 2	(Aug 23, 25)	Technical setup, applications of Newton's laws, ODEs	[§1.1-1.7, §2.6]
Week 3	(Aug 30, Sep 1)	Projectiles and drag	[§2.1-2.7]
Week 4	(Sep 8)	[NO MONDAY MEETING, LABOR DAY] Momentum and angular momentum	[§3.1-3.5]
Week 5	(Sep 13, 15)	Work, potential, energy	[§4.1-4.2]
Week 6	(Sep 20, 22)	Forces, vector analysis	[§4.3-4.7]
Week 7	(Sep 27, 29)	Central forces, spherical coordinates, gravity	[§4.8-4.10]
Week 8	(Oct 4, 6)	[MIDTERM OCT 6]	
Week 9	(Oct 11, 13)	Two-body problems	[§8.1-8.3]
Week 10	(Oct 18, 20)	Kepler orbits	[§8.4-8.8]
Week 11	(Oct 25, 27)	Simple harmonic motion	[§5.1-5.3]
Week 12	(Nov 1, 3)	More complex oscillations	[§5.4-5.6]
Week 13	(Nov 8, 10)	Rigid bodies, Center of mass	[§10.1]
Week 14	(Nov 15, 17)	Rotations, Inertia tensor	[§10.2-10.3]
Week 15	(Nov 22)	[NO CLASS DAY NOV 24]	
Week 16	(Nov 29, Dec 1)	Using the inertia tensor	[§10.4-10.6]

## COVID-19 Policies

As of Fall 2021, we remain in an unprecedented pandemic that requires careful and strict policies in the classroom environment. The health of the community is of paramount importance. In the event that the local situation requires a change of teaching environment, this will be clearly communicated and will follow the guidelines of the university.

**Masks:** With the spread of the Delta variant of COVID-19, students, faculty, and staff will be required to wear masks in classrooms, labs, and for indoor academic events required for students such as orientation regardless of vaccination status. This requirement will remain in place until conditions improve and the university communicates new instructions.

**Vaccination:** The university strongly recommends that all members of the campus community be vaccinated for their own protection, to prevent disruption to the semester, and to prevent the spread of COVID-19. Vaccination information and appointment signups are available at [tiny.utk.edu/vaccine](http://tiny.utk.edu/vaccine). The Student Health Center medical staff is available to students to answer questions or discuss concerns about vaccines, and the center provides vaccines free of charge for anyone 18 years or older who would like one.

**Reporting:** If you begin to feel sick or you have been in contact with someone who has COVID-19, the first step is to begin self-isolating immediately and fill out the university's self-isolation form. You should contact the Student Health Center or your preferred health care provider. You can also contact the university's COVID-19 support team for guidance by filling out the COVID-19 self-isolation form at [covidform.utk.edu](http://covidform.utk.edu).

**Attendance** You must not attend class if you have tested positive for COVID-19 and are in the isolation period, if you have COVID-19 symptoms and have not been cleared by a medical provider, or if you are an unvaccinated close contact in the quarantine period. If you need to miss class for illness, please contact the instructor as soon as possible via Email.

**Make Up/Late Work** If you are feeling well enough, you should keep up with the course readings and assignment due dates. Contact me in order to ensure all material is made available to you. If you are too ill to complete daily tasks, we will discuss accommodations individually. It is your responsibility to reach out to me before returning to class to set up a time to discuss these accommodations.

You can find more information and updates at [utk.edu/coronavirus](http://utk.edu/coronavirus).