PHYS 4101/6101: Theoretical Mechanics I
University of Georgia, Fall 2021
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Class time: TR Period 5, 2:20-3:35 pm
Class location: Physics Building, Room 327
Office hours: TBA
Textbook: *Classical Mechanics*, by John R. Taylor (University Science Books, Sausalito, 2005)
Web site: elc.uga.edu; check this site regularly for announcements

Prerequisites
PHYS 3700 (Modern Physics)
PHYS 3900 (Math Methods of Physics)
MATH 2700 (Differential Equations)

Synopsis
This is the first semester of a two-semester sequence on classical mechanics for undergraduate physics majors. We will cover the first seven chapters of *Classical Mechanics* by J. R. Taylor.

This course builds on your knowledge of Newtonian mechanics, treated in a more mathematically sophisticated fashion. We will learn how to turn Newton's Second Law, $\boldsymbol{F}=m\boldsymbol{a}$, into a set of differential equations, the solutions to which will determine particle motion and trajectories. The theoretical development will also emphasize the importance of conservation laws and conserved quantities, such as energy, linear momentum, and angular momentum. The relationship between these conservation laws and physical symmetries forms the cornerstone of modern theoretical physics, and this course will provide the first glimpse of these important (and beautiful!) connections. We will also cover variational principles in mechanics, and develop an alternative, but equivalent, approach to mechanics called *Lagrangian mechanics*. The Lagrangian formulation, and the related *Hamiltonian* formulation, are central to the development of quantum mechanics.

Course Schedule
The following schedule of topics is tentative and subject to change. We will closely follow the textbook.

Fundamental Concepts: Vectors, Coordinates	2 lectures
Newtonian Mechanics: Laws of Motion (Chapter 1)	3 lectures

Motion of a Particle: Projectiles, Charges (Chapter 2)	3 lectures
Momentum, Angular Momentum, Systems of Particles (Chapter 3)	3 lectures
Energy (Chapter 4)	4 lectures
Oscillations (Chapter 5)	3 lectures
Variational Principle (Chapter 6)	4 lectures
Lagrangian Mechanics (Chapter 7)	4 lectures

Grading Policy

Homework:	10 assignments, lowest two grades are dropped	400 points
Preliminary exam 1:	tentatively on Sept. 28, Chapters 1-3	150 points
Preliminary exam 2:	tentatively on Nov. 4, Chapters 4, 5, and part of 6	150 points
Final exam:	Chapters 1-7	300 points
TOTAL		**1000 points**

Letter grade cutoffs will be no *higher* than the following:

A-= 830-869	A = 870-100	
B-= 680-719	B = 720-789	B+ = 790-829
C-= 530-569	C = 570-639	C+ = 640-679
D = 400-529	F = 0-399	

Actual grade ranges may end up having *lower* cutoffs.

Exams

There will be two preliminary exams during the semester, to be held during regular class times. If you need to miss an exam for a legitimate and documented reason, you must contact me before the exam if possible, or else as soon as possible after the exam. Make-up exams will be given only for legitimate, documented reasons and only if you notify me in a timely fashion.

Homework

The best way to learn the material is to work problems. You will have regular homework assignments, with a mix of problems of varying complexity. It is important to attempt all problems—if you are struggling, please seek help from me or from a classmate. In general, the homework will be assigned on Tuesdays and due one week later. I will make every effort to return graded assignments one week after they are due, and post solutions on eLC. Late homework will be marked down 10% for each day late; once solutions have been posted late work will not be accepted. Unless otherwise noted, all assignments are weighted equally. The two lowest homework scores will be dropped. This policy compensates for the unavoidable circumstances that may prevent you from submitting homework on time (e.g., illness, scheduled event, emergency, etc.). Homework problems will be graded not only for correctness of the result, but also on process.

Collaboration

You may collaborate with others on the homework assignments. However, I expect each student to turn in assignments written up independently; if you worked with others, or

you received assistance from others (including me), I expect you to note this on your assignment (just as you would if you were writing a scientific paper). Be careful not to rely too heavily on others, as this may impede your own understanding of the material. Finally, you should not "data mine" the internet for solutions to the problems – doing so may undermine your ability to master the material, and those solutions are sometimes wrong!

Class Attendance
While class attendance is not required, you are strongly encouraged to attend all class meetings. Why? While I do plan to cover material as it is laid out in the textbook, I will take detours, discuss interesting applications, work sample problems, and answer your questions during the lectures. And of course, you don't want to miss the occasional amusing anecdote.

Graduate and Honors Credit
Students who wish to receive graduate level credit for this course should enroll in PHYS 6101. Students in PHYS 6101, as well as those who wish to receive Honors-option credit for PHYS 4101, should make an appointment to meet with me early in the semester to discuss a term project to be completed in addition to the assignments for PHYS 4101.

Course and University Policies

Academic Honesty
"I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others."

UGA has a comprehensive academic honesty policy, A Culture of Honesty, which is available from the Office of Instruction at https://honesty.uga.edu/. This policy covers all academic work. All students are responsible for fully understanding and abiding by this policy.

Disability Accommodations
I will accommodate students with disabilities. Students requesting accommodations must provide documentation from the Disability Resource Center in a timely fashion.

Withdrawals/Incompletes
The Undergraduate Bulletin and the Registrar's Office website describe the University policies regarding withdrawals and incompletes. If you are considering withdrawing from the course, you should discuss your choice with me beforehand.

CORONAVIRUS INFORMATION FOR STUDENTS FOR FALL 2021 CLASSES

Face Coverings:
Following guidance from the University System of Georgia, face coverings are recommended for all individuals while inside campus facilities.

How can I obtain the COVID-19 vaccine?
University Health Center (UHC) is scheduling appointments for students through the UHC Patient Portal (https://patientportal.uhs.uga.edu/login_dualauthentication.aspx). Learn more here – https://www.uhs.uga.edu/healthtopics/covid-vaccine.

The Georgia Department of Health, pharmacy chains and local providers also offer the COVID-19 vaccine at no cost to you. To find a COVID-19 vaccination location near you, please go to: https://georgia.gov/covid-vaccine.

In addition, the University System of Georgia has made COVID-19 vaccines available at 15 campuses statewide and you can locate one here: https://www.usg.edu/vaccination.

What do I do if I have COVID-19 symptoms?
Students showing COVID-19 symptoms should self-isolate and schedule an appointment with the University Health Center by calling 706-542-1162 (Monday-Friday, 8 a.m. 5p.m.). Please DO NOT walk-in. For emergencies and after-hours care, see https://www.uhs.uga.edu/info/emergencies.

What do I do if I test positive for COVID-19?
If you test positive for COVID-19 at any time, you are **required to report it** through the DawgCheck Test Reporting Survey. We encourage you to stay at home if you become ill or until you have excluded COVID-19 as the cause of your symptoms. UGA adheres to current Georgia Department of Public Health (DPH) quarantine and isolation guidance and requires that it be followed. Follow the instructions provided to you when you report your positive test result in DawgCheck.

Guidelines for COVID-19 Quarantine Period (As of 8/1/21; follow DawgCheck or see DPH website for most up-to-date recommendations)
Students who are fully vaccinated **do not** need to quarantine upon exposure unless they have symptoms of COVID-19 themselves. All others should follow the Georgia Department of Public Health (DPH) recommendations:

Students who are not fully vaccinated and have been directly exposed to COVID-19 but are not showing symptoms **should self-quarantine for 10 days**. Those quarantining for 10 days must have been symptom-free throughout the monitoring period and continue self-monitoring for COVID-19 symptoms for a total of 14 days. You should report the need to quarantine on DawgCheck (https://dawgcheck.uga.edu/) and communicate

directly with your instructor to coordinate your coursework while in quarantine. If you need additional help, reach out to Student Care and Outreach (sco@uga.edu) for assistance.

Students, faculty, and staff who have been in close contact with someone who has COVID-19 are no longer required to quarantine if they have been fully vaccinated against the disease and show no symptoms.

Well-being, Mental Health, and Student Support
If you or someone you know needs assistance, you are encouraged to contact Student Care & Outreach in the Division of Student Affairs at 706-542-7774 or visit https://sco.uga.edu/. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services.

UGA has several resources to support your well-being and mental health: https://well-being.uga.edu/.

Counseling and Psychiatric Services (CAPS) is your go-to, on-campus resource for emotional, social and behavioral-health support: https://caps.uga.edu/, TAO Online Support (https://caps.uga.edu/tao/), 24/7 support at 706-542-2273. For crisis support: https://healthcenter.uga.edu/emergencies/.

The UHC offers free workshops, classes, mentoring, and health coaching led by licensed clinicians or health educators: https://healthcenter.uga.edu/bewelluga/.