

Mechanics – Physics 420

SUNY Cortland Physics Dept.

Catalog Description

The study of the motion of physical bodies at the macroscopic level. Topics include the dynamics of a particle, the harmonic oscillator, motion in three dimensions, central forces, systems of particles, and rigid bodies. Prerequisites: PHY 202 and MAT 237.

The Point of this Class

In Physics 201 you became familiar with mechanics through Newton's laws and conservation laws (momentum and energy). In this course we will make the first steps toward deepening the sophistication with which you approach mechanics. Some of this will come from your learning to apply mathematical tools such as series expansion, vector calculus, differential equations, symbolic solvers, and numerical integration. Some will come from learning a new mathematical formalism for deriving the equations of motion for an object using Lagrangians and Hamiltonians.

At the end of this course you should expect to be able to recall and apply:

- The core principles of classical mechanics.
- The mathematical methods of solution in classical mechanics.

Basic Information

Instructor: Doug Armstead

Office: 127 Bowers (607) 753-2919

Office Hours: M 10-11am, T 11-noon, W 3-4pm, F 10-11am. These are just the times I guarantee. I am available other times so feel free to drop by or to email me for an appointment.

Email: douglas.armstead@cortland.edu

Course website: www.facultyweb.cortland.edu/douglas.armstead/F23/Mechanics.html

Lecture meets: MWF 9:10-10am in Bowers 1113.

Texts: *Analytical Mechanics 7th Ed.* by Fowles and Cassiday published by Thomson Brooks/Cole.

Pre-requisites: Physics 202 and Multivariate calculus

Expectations

What you should expect from me:

- Explanations of physical concepts that include concrete examples and, where reasonable, demonstrations.
- In-class examples that help you to develop the level of reasoning that is necessary to do the problems you will encounter in the homework and on exams.
- Careful and respectful consideration of your questions.
- An open door policy—if my office door is open you should feel free to come in and talk about physics. This is in addition to my regularly scheduled office hours listed above.

What I expect of you:

- Your presence in class, both physical and mental, for the entire class period.
- If you have a question, ask it. Your fellow classmates will thank you—if you are unclear on something, chances are the person next to you is, too.
- Be considerate of your fellow classmates by turning off your cell phones during class and not eating in class.
- Submit work for grading that is your own. If you copy from another student or source and submit it for a grade, then you risk receiving an F in the course.

Grades

The final score for the class is found in the following way:

$$score = \frac{H + E_1 + E_2 + F}{4} \quad (1)$$

where H =homework average, E_i = ith exam, and F =final exam.

Graded Elements

The point of the homework is to develop a clear understanding of the problems. This entails mastering the concept, technique, and thought process that leads from beginning to end using a clear, methodical plan. There are many aids at your disposal: the instructor, in and out of class; your classmates; and the library. But in the end nothing beats quiet concentration and gradually sorting things out for yourself.

The goal of the homework is the demonstration of the logic that leads to the answer, not the answer itself. This will also be the way the exams are evaluated. A make-up exam will only be administered for “Excused Absences” (see pages 70-71 of Undergraduate Catalog for details). Supporting documentation to excuse your absence will be required.

The score is mapped into a grade roughly as:

Final %	Grade
90-100	A- to A
80-89	B- to B+
70-79	C- to C+ etc.

Improvement and class participation may be used raise a border line grade.

Academic Integrity¹

Honesty is an essential part of academic integrity and at the heart of scientific research. Scientists and other scholars take pride in ownership of their own work. They do not take credit for the effort or ideas of others and do not tolerate those who do. This includes cheating, plagiarism and not contributing to group projects. This concept is based on mutual trust. If you cheat you are chipping away at your own moral character and undermining the overall integrity of our college society. Violations of this trust are acts of academic dishonesty; offenses will not be tolerated and may result in a zero on that assignment or in failure for the course.

Obviously, cheating on tests or quizzes involves using information to which you are not entitled such as copying or receiving information from a classmate or using notes other than those permitted by the instructor.

Plagiarism, according to *Webster’s New Collegiate Dictionary* is to steal or pass off the ideas and words of another person as new and original an idea or product derived from an existing source. Obviously using work from another student who has previously taken this course is plagiarism.

Group work and group projects are valuable learning experiences, and will be the basis of most lab work. However, it is a form of dishonesty to claim credit for work to which you have not contributed.

I encourage students to work together in discussing methods of solutions to problems in homework assignments. Seek help from the instructor, but only after you have reached an impasse in your own concentrated effort. Much valuable learning can occur in the *active participation* in such discussions. However, because you are placing your name alone on an assignment, you should then write up your own original solutions. You are not being honest if you just copy another’s solution without any thought of your own.

READ (and understand) the College’s statements and procedures on Academic Integrity in the Undergraduate Catalog. Ask the instructor if you have any uncertainty about what is proper and what is not.

¹Adapted from Dr. William L. Johnson’s statement of academic integrity.

Disability Statement

As part of SUNY Cortlands commitment to a diverse, equitable, and inclusive environment, we strive to provide students with equal access to all courses. If you believe you will require accommodations in this course, please place a request with the Disability Resources Office at disability.resources@cortland.edu or call 607-753-2967. Please note that accommodations are generally not provided retroactively so timely contact with the Disability Resources Office is important. All students should consider meeting with their course instructor who may be helpful in other ways.

Diversity Statement

SUNY Cortland is dedicated to the premise that every individual is important in a unique way and contributes to the overall quality of the institution. We define diversity broadly to include all aspects of human difference. The College is committed to inclusion, equity, and access and thus committed to creating and sustaining a climate that is equitable, respectful and free from prejudice for students, faculty and staff. We value diversity in the learning environment and know that it enhances our ability to inspire students to learn, lead and serve in a changing world. We are committed to promoting a diverse and inclusive campus through the recruitment and retention of faculty, staff and students. As a community, we hold important the democracy of ideas, tempered by a commitment to free speech and the standards of inquiry and debate. To this end, we are dedicated to developing and sustaining a learning environment where it is safe to explore our differences and celebrate the richness inherent in our pluralistic society.

Inclusive Learning Environment Statement

SUNY Cortland is committed to a diverse, equitable and inclusive environment. The course instructor honors this commitment and respects and values differences. All students enrolled in this course are expected to be considerate of others, promote a collaborative and supportive educational environment, and demonstrate respect for individuals with regard to ability or disability, age, ethnicity, gender, gender identity/expression, race, religion, sex, sexual orientation, socio-economic status or other aspects of identity. In an environment that fosters inclusion, students have the opportunity to bring their various identities into conversation as they find helpful, but are not expected to represent or speak for an entire group of people who share aspects of an identity. If you have any questions or concerns about this statement, contact the Institutional Equity and Inclusion Office at 607-753-2263.

Title IX Statement

Title IX, when combined with New York Human Rights Law and the New York Education Law 129-B, prohibits discrimination, harassment and violence based on sex, gender, gender identity/expression, and/or sexual orientation in the education setting. The federal Clery Act and NY Education Law 129-B provide certain rights and responsibilities after an incident of sexual or interpersonal violence. When a violation occurs, victims and survivors are eligible for campus and community resources. Where the College has jurisdiction, it may investigate

and take action in accordance with College policy. If you or someone you know wishes to report discrimination based in sex, gender, gender identity/expression, and/or sexual orientation, or wishes to report sexual harassment, sexual violence, stalking or relationship violence, please contact the Title IX Coordinator at 607-753-4550, or visit cortland.edu/titleix to learn about all reporting options and resources. (Updated by SUNY Legal Feb. 1, 2018).

Tentative Class Schedule

Week	week starting	Chapter(s)	Topic
1	Aug. 28	1 &2	Intro & Motion in 1-D
2	Sept. 4	2	Motion in 1-D (Labor Day on M, no class)
3	Sept. 11	3	Oscillations
4	Sept. 18	3	Oscillations
5	Sept. 25	1	Vectors
6	Oct. 2	4	Motion in 2-D and 3-D
7	Oct. 9	4	Motion in 2-D and 3-D Test: Chapters 1-3 on Mon. Oct. 9.
8	Oct. 16	5	Noninertial Reference Systems (Fall Break on M&T)
9	Oct. 23	6	Gravitation and Central Forces.
10	Oct. 30	6	Gravitation and Central Forces.
11	Nov. 6	10	Lagrangian Mechanics.
12	Nov. 13	10	Lagrangian Mechanics. Test: Chapters 4-6 on Mon. Nov. 13.
13	Nov. 20	7	Dynamics of Systems of Particles. (Thanksgiving W-F)
14	Nov. 27	7	Dynamics of Systems of Particles.
15	Dec. 4	8	Rigid Body Rotation.
16	Dec. 11	8	Rigid Body Rotation & Review.

Final Exam from 8:30-10:30am on Wednesday, December 13, 2023