Carleton University Physics Department
PHYS 3802 - Advanced Dynamics
Fall 2026 Course Outline

We, the people of the Faculty of Science at Carleton University, acknowledge that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Miigwetch for your hospitality and stewardship of this territory and the teachings that come from it. We are grateful for this land, the air that we breathe, and the water that sustains us all as well as for the animals, plants and other living beings: these enable us to research, teach, mentor, support, study, and learn. We recognize our responsibility to our natural environment and to reconciliation with Indigenous peoples.

Instructor: Prof. Daniel Stolarski (he/him)
How to Address Me: Professor Stolarski
Email: stolar@physics.carleton.ca
Office: HP3320

If you have a question or would like to talk with me, you can send an email, visit me during student hours (see below), or approach me after lecture.

Course Schedule: Monday & Wednesday, 11:35 AM - 12:55 PM.

Class Location: Please check Carleton Central for the room location.

Course Delivery: The course will consist of synchronous meetings that will follow an in-person model where we will gather in our classroom. I will lead a discussion of the course material in a lecture format (chalk-and-talk). Students are encouraged to ask questions and engage with the material during the lecture. These sessions are the primary method of course delivery. Regular attendance is expected and contributes 5% of the course grade; see Evaluation below.

Electronics: Use of electronics in class including cell phones and laptops is **forbidden** except in the case of a written accommodation. Tablets are allowed **only for notetaking purposes.** Students using permitted electronic devices are asked, where feasible, to sit where their screens will be least distracting to other students.

Calendar Description: Equations of motion for a single particle. Oscillatory Motion. Lagrangian and Hamiltonian formulations of mechanics. Central force motion. Motion of systems of particles and of rigid bodies.

Learning Outcomes: By the end of this course, students should be able to:

- formulate and analyze mechanical systems using Newtonian, Lagrangian, and Hamiltonian methods;
- apply variational methods and conservation laws to problems in classical mechanics;
- analyze central-force motion;
- analyze single and coupled oscillators including damping; and
- describe the dynamics of systems of particles and rigid bodies.

Prerequisites: PHYS 2305 and either (MATH 2001 and 2002) or MATH 2004, or permission of the Department.

Course webpage: See Brightspace

Teaching Assistant: William Rettie (he/him), WilliamRettie@cmail.carleton.ca.

Student Hours (formerly called office hours): Prof. Stolarski will have student hours in HP 3320 on

- Mondays 1-2 PM (after lecture),
- Tuesdays 11-noon,
- or by email appointment.

If you have questions about marking assignments, please email William.

Required Textbook: Classical Dynamics of Particles and Systems [Fifth Edition] S. T. Thornton and J. B. Marion, Brooks/Cole, Cengage Learning - 2008. Older editions of this book are also acceptable. The approximate cost of the hardcover version of this book is $113, and the approximate cost of the paperback version is $45. You are welcome to find used or PDF versions of the book.

Inclusive teaching statement: Science is for everyone. I am committed to fostering an environment for learning that is inclusive for everyone regardless of gender identity, gender expression, sex, sexual orientation, race, ethnicity, ability, age, class, etc. All students in the class, the instructor, and any guests should be treated with respect during all interactions. It is my hope that our class will support diversity of experience, thought, and perspective. I will continually strive to create inclusive learning environments and would therefore appreciate your support and feedback. I welcome emails or in-person communications to let me know your preferred name or pronoun. Please see the Faculty of Science Equity, Diversity, and Inclusion (EDI) statement.

Mental Health: Taking classes at university can be difficult and stressful. If you are struggling with your mental health, please do not hesitate to reach out. I can direct you to resources that might help. Remember that Carleton also offers an array of mental health and well-being resources, which can be found here.

Statement on AI Use: Artificial intelligence and generative AI tools have become increasingly sophisticated. They can be useful for learning physics, but they can also interfere with the process of developing independent problem-solving skills. In this course, students may use AI tools to clarify course concepts, review background mathematics, summarize textbook material, suggest additional reading, or generate practice problems that are not based on assigned problems. Students should be aware that AI tools can provide incorrect or misleading information and should not be relied upon as authoritative sources.

AI tools may not be used to assist with assigned problems before the assignment is submitted, and doing so constitutes academic misconduct. In particular, students may not provide an assigned problem, or a substantially similar version of it, to an AI tool; ask an AI tool for hints, intermediate steps, solutions, or relevant methods for an assigned problem; or use an AI tool to check, correct, or improve their solution to an assigned problem.

One of the main learning outcomes of this course is to teach you how to solve technically sophisticated problems, particularly in classical physics. These skills are developed through sustained effort on difficult problems. This AI policy reinforces my teaching philosophy that learning comes

from hard work and struggle on problems. Furthermore, the practice acquired by solving problems independently is *necessary* for success on the exams in this course.

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

I used ChatGPT 5 to copy edit and improve the wording of this course outline.

Evaluation:

The marks for this course will be assigned as:

- Attendance - 5%
- Assignments - 25%
- Midterm 1 - 20%
- Midterm 2 - 20%
- Final - 30%

Attendance:

I will take attendance using a Wooclap poll accessible from brightspace. The poll will open at 11:30, five minutes before the start at lecture, and close at 11:40, five minutes after the start of lecture. The answer to the poll will be given in lecture. It is an academic offence to share the answer of the poll with someone who is not attending lecture.

The credit for attendance will be given as:

Attendance percentage	Points awarded
75% - 100%	5
50% - 74%	3
0% - 49%	0

Note that lectures with midterms do not count towards the percentage.

Assignments:

Assignments will be given approximately once per week and will be due on Tuesdays at 11:59 PM. All assignments carry the same weight. The assignments will be posted on and submitted to Brightspace. Students may handwrite their solutions and scan or photograph them to upload to the website. **Please upload a single PDF file.**

As noted above, working through problems is essential for developing a deep understanding of the subject, since the course material is heavily mathematical. **Students are permitted to discuss concepts and strategies related to solving the homework assignments; however, the work handed in must be their own.** Before an assignment is submitted, students may not view, search for, or use solutions to the assigned problems or to problems that are substantially

similar to them. This includes solutions from solution manuals, websites, other students, current or previous course materials, or AI tools.

Students are permitted to consult the textbook, lecture notes, and other resources to review concepts, mathematical techniques, and worked examples that are not solutions to the assigned or substantially similar problems. If you are unsure whether a particular resource is permitted, please ask before using it.

Work submitted for grading must represent the student's own reasoning and calculations. Use of prohibited solutions or assistance will be considered academic misconduct.

Late assignments will not be accepted without a legitimate reason, such as illness. In order to receive accommodation for a late assignment, students should request the accommodation **before** the deadline whenever reasonably possible, or as soon as possible afterward.

Students who are having significant difficulties with the material are encouraged to attend my student hours or email me to arrange an appointment at another time. Requests for appointments outside regular student hours should be made with sufficient notice.

Midterm Exams:

There will be two 80-minute midterms administered in class on **October 7** and **November 18**. Both midterms are cumulative, although the second midterm will emphasize material taught after the first midterm. The midterms will be closed-book and closed-notes, and calculators cannot be used. Students may prepare their own formula sheet on one 8.5" $\times$ 11" (letter-size) sheet of paper, using both sides. The sheet may contain formulas, definitions of symbols, and diagrams. It may not contain worked examples, derivations, step-by-step instructions, or solutions to specific problems. The formula sheet must be submitted with the exam.

In the case of an exam deferral for legitimate reasons, you must inform me within 24 hours of the regularly scheduled midterm to arrange a time to write the deferred exam.

Final Exam:

The final exam will be held in person during the final exam period in December, and will be 3 hours long. The final exam is cumulative, although it will emphasize material from the second half of the course. Like the midterms, the final exam will be closed-book and closed-notes, and calculators are forbidden. Students will again be allowed to write their own formula sheet, with the same criteria as for the midterms.

Course Schedule

Below is a rough schedule of the course, but it may change to fit the pace needed.

Dates	**Textbook**	**Topic Description**
Sep 9, 14	Chap. 1 (not 1.17)	Introduction and Math Preliminaries
Sep 16, 21, 23	Chap. 2	Newtonian Mechanics – Single Particle
Sep 28, 30, Oct 5	Chap. 6	Calculus of Variations
Oct 7		**First Midterm**
Oct 14, 19, 21	Chap. 7 (not 7.12–13)	Lagrangian and Hamiltonian Dynamics
Oct 26 & 28	Fall Break	No classes
Nov 2	Chap. 5 (not 5.3, 5.4)	Gravitation
Nov 4, 9	Chap. 8 (not 8.8–8.10)	Central Force Motion
Nov 11, 16	Chap. 3	Oscillations
Nov 18		**Second Midterm**
Nov 23, 25	Chap. 12	Coupled Oscillations
Nov 30, Dec 2	Chap. 9	Systems of Particles
Dec 7, 9, 11	Chap. 11	Rigid Bodies

Academic Accommodations and Regulations: Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website.

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website.

Statement on Academic Integrity: Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here. Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights and Responsibilities: Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7

Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Grade Definition: In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	A = 85-89	A- = 80-84
B+ = 77-79	B = 73-76	B- = 70-72
C+ = 67-69	C = 63-66	C- = 60-62
D+ = 57-59	D = 53-56	D- = 50-52
F < 50	WDN = Withdrawn from the course	

Course Copyright: Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

Assistance for Students:

- Paul Menton Centre
- Academic Advising Centre (AAC)
- Centre for Student Academic Support (CSAS)
- Math Tutorial Centre
- Science Student Success Centre
- Health and Counselling Services
- Equity and Inclusivity Communities