

**CARLETON UNIVERSITY  
DEPARTMENT OF PHYSICS**

**PHYS 3802 A  
FALL 2022  
ADVANCED DYNAMICS**

**Instructor:** Razvan Gornea

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**Course lectures**

Mondays and Wednesdays, 16h05 to 17h25 in SA 311

**Pre-requisites & Precluded Courses**

PHYS 2202, PHYS 2604 and MATH 2004 (or with special permission from the Physics Department)

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## Course Description and Objectives

This course introduces the Lagrange and Hamiltonian formulation of classical mechanics in a series of lectures illustrated by a wide set of applications. Course content and reading advice are

1. Introduction and mathematical preliminaries (3h)  
*Chapter 1 "Matrices, Vectors, and Vector Calculus"*
2. Newtonian mechanics of a single particle (6h)  
*Chapter 2 "Newtonian Mechanics - Single Particle"*
3. Lagrangian and Hamiltonian dynamics (6h)  
*Chapter 6 "Some Methods in the Calculus of Variations"*
4. Hamiltonian dynamics (4.5h)  
*Chapter 7 "Hamilton's Principle - Lagrangian and Hamiltonian Dynamics"*
5. Mid-term revision (1.5h)  
*November 2: Revision and exam example (distributed two weeks before)*
6. Applications: Small amplitude oscillations (6h)  
*Chapter 3 "Oscillations" & Chapter 12 "Coupled Oscillations"*
7. Applications: Rotation of rigid bodies (6h)  
*Chapter 11 "Dynamics of Rigid Bodies"*
8. Applications: Central force motion (3h)  
*Chapter 8 "Central-Force Motion"*
9. End of term revision (1.5h)  
*December 9: Revision and exam example (distributed one week before)*

## Textbook

Classical Dynamics of Particles and Systems [Fifth Edition]  
*S.T. Thornton and J.B. Marion*  
Brooks/Cole, Cengage Learning - 2008

## Course Requirements & Methods of Evaluation

Grades distribution:

- assignments count for **63%** [9 x 7% each]
- final examination counts for **37%**

There will be 9 assignments given during the term. Each is due (through email or uploaded in Brightspace directly to the TA) roughly a week after distribution. You are encouraged to discuss these problems with your colleagues but *the submitted work must be your own*. Figuring out the assignment is the best way to learn the course material and be successful!

## University policies

### 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 | B+ = 77-79 | C+ = 67-69 | D+ = 57-59 |
| A = 85-89   | B = 73-76  | C = 63-66  | D = 53-56  |
| A- = 80-84  | B- = 70-72 | C- = 60-62 | D- = 50-52 |
| F = <50     |            |            |            |

WDN = Withdrawn from the course

ABS = Student absent from final exam

DEF = Deferred (See above)

FND = (Failed, no Deferred) = student could not pass even with 100% on final exam

### Academic Regulations, Accommodations, Plagiarism, Etc.:

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here:

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/>

### Academic Accommodations for Students with Disabilities:

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at **613-520-6608** or **pmc@carleton.ca** for a formal evaluation.

If you are already registered with the PMC, contact your PMC coordinator to send your **Letter of Accommodation** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation ( *if applicable* ).

[carleton.ca/pmc](http://carleton.ca/pmc)

### For Religious Obligations:

Students requesting academic accommodations on the basis of religious obligation should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory event.

Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student.

Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance.

[carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

### For Pregnancy:

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required.

[carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

**Plagiarism:**

Plagiarism is the passing off of someone else's work as your own and is a serious academic offence. For the details of what constitutes plagiarism, the potential penalties and the procedures refer to the section on Instructional Offences in the Undergraduate Calendar.

**What are the Penalties for Plagiarism?**

A student found to have plagiarized an assignment may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; award of an FNS, Fail, or an ABS.

**What are the Procedures?**

All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.

The Dean writes to the student and the University Ombudsperson about the alleged plagiarism. The Dean reviews the allegation. If it is not resolved at this level then it is referred to a tribunal appointed by the Senate.

Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy (see <https://carleton.ca/registrar/academic-integrity/>). The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

**Assistance for Students:**

Academic and Career Development Services: <http://carleton.ca/sacds/>

Writing Services: <http://www.carleton.ca/csas/writing-services/>

Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/group-support/pass/>

Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>

Science Student Success Centre: <https://sssc.carleton.ca/>

**Important Information:**

- Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).
- Students must always retain a hard copy of all work that is submitted.
- Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.
- Carleton University is committed to protecting the privacy of those who study or work here (currently and formerly). To that end, Carleton's Privacy Office seeks to encourage the implementation of the privacy provisions of Ontario's *Freedom of Information and Protection of Privacy Act* (FIPPA) within the university.
- In accordance with FIPPA, please ensure all communication with staff/faculty is via your Carleton email account. To get your Carleton Email you will need to activate

your MyCarletonOne account through Carleton Central. Once you have activated your MyCarletonOne account, log into the MyCarleton Portal.

**Important Dates:**

A [full list of important dates](#) is available on the Calendar website. The last date for Academic WD is November 15.

*Please note that the academic withdrawal dates have changed recently.*

Always consult the Calendar website for the most updated information:

<https://calendar.carleton.ca/academicyear>