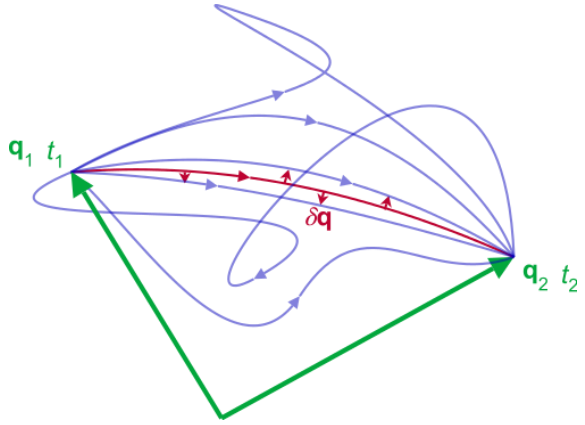
# *Classical Mechanics*

## PHYS-311, Spring 2018




**Meets @ SC1343:**
Tu & Th 2:00-3:20pm

**Office Hours @ SC1330:**
Mon 3-5pm, Fri 10:30am-12:30pm, or email

**Course Goals:** In this class we will explore how things move; how to describe motion. Our goal will be to develop a conceptual understanding of the core concepts of classical physics such as mass, momentum, angular momentum, force, torque, and the conservation laws. We will also learn the general formalism of Lagrangian and Hamiltonian mechanics, and use them to solve classical mechanics problems. We will develop skills to formulate and solve problems analytically and/or numerically.

**Course Book and Website:** *Classical Dynamics of Particles and Systems* by Thornton and Marion. Fourth edition or newer should work just fine for our needs. Please keep in mind that the textbook will be a general guide only. We will cover certain aspects in more detail than the book, and some in less detail. Exam/HW/project problems will be based on topics discussed in the class. HWs etc. will be posted on the *onCourse* website for this class.

**Grading scheme:**

- Take home exams (Midterm 1: 15%, Midterm 2: 15%, Final: 20%) …… 50%
- Homeworks ……..……...…… 30%
- Projects …….. 20%

**Exams:** There will be 3 exams over the course of the semester. See the course calendar below for the dates. There will be no make-up exams under ordinary circumstances, so please plan accordingly.

**Homework:** Weekly HW will include questions and problems covering class topics.

**Projects:** We want you to get inspired and have new experiences, and to learn classical mechanics through trying new things. So, throughout the term, we will issue special projects to the class. These projects will include solving challenging problems, sometimes analytically or sometimes numerically.
You are also strongly encouraged to attend **Physics/Astronomy Seminars** held during the semester. Submitting a 1-page write-up of what you learned during each seminar will earn you $\pi$ % extra credit.

**Grading Scale:** You will not be graded on a curve. Your test grades will be scaled according to the table on the right. This absolute scale is designed, in part, to encourage you to work together. Please help one another inside and outside of class!

| Grade | + | | - |
|---|---|---|---|
| **A** | **>96** | **92-96** | **88-92** |
| **B** | **85-88** | **81-85** | **77-81** |
| **C** | **72-77** | **67-72** | **63-67** |
| **D** | **60-63** | **56-60** | **52-56** |
| **F** | **<52** | | |

**Attendance and Late Work Policy:** Class attendance and participation is expected. Absences for school-sanctioned

events will be excused. Please know that it is your responsibility to inform me in case of absence due to serious or prolonged illness. Except in case of lateness due to illness or school-sanctioned events, homework and labs must be turned in by the stated deadline to get full credit. Every week's worth of delay will cost 10% of the maximum score. E.g. if you turn in a HW (that is originally worth, say, 10 points) 3 weeks late, then you can get only 7 points max for that HW.

**Academic Integrity and Honor Code:** I encourage you to work together on homework assignments, but straight copying of someone else's work is a violation. When in doubt, please acknowledge the work of the students that you studied with.

**Accommodations:** Wheaton is committed to ensuring equitable access to programs and services and to prohibit discrimination in the recruitment, admission, and education of students with disabilities. Individuals with disabilities requiring accommodations or information on accessibility should contact Abigail Cohen, Assistant Dean for Accessibility and Assistive Technology at the Filene Center for Academic Advising and Career Services. ~ cohen_abigail@wheatoncollege.edu or (508) 286-8215.

| **Class Schedule** | |
|---|---|
| **Topics** | **Reading: chapter.section** |
| Newton's laws; Inertial and non-intertial frames; Conservative and non-conservative forces, Equation of motion of a falling object under gravity, Conservation Laws | 2 |
| Solving differential equations numerically; Drag and terminal velocity | |
| Simple harmonic oscillator, Phase diagrams, damped simple harmonic oscillator, Analytic and numerical solutions for harmonic oscillators, Forced oscillations and resonance | 3 |
| Projectile motion with air resistance, Rocket motion | 2.4, 9.11 |
| Motion in a Noninertial Reference Frame, Rotating Coordinate systems, Coriolis Effect | 10 |
| Calculus of Variations, Euler Equation and applications, Fermat's principle and Snell's laws, Euler equation with constraints | 6 |
| Generalized coordinates and momenta, Lagrange's equation with undetermined multipliers, Cyclic coordinates and conservation principles, Equivalence of Lagrangian and Newtonian equations, Canonical equation of motion and Hamiltonian dynamics | 7 |
| Central Force, Two body problem, reduced mass, Conservation theorems and equations of motion, Orbits in a central force field | 8 |
| System of particles, Center of mass, Linear momentum, Angular momentum, and Energy of the system, Collisions and Scattering | 9 |

| **Some special dates** | |
|---|---|
| 03/06 Tu -- 03/09 Fri | **Mid-term I. Take home. No class on 03/06, but we will meet on 03/08.** |
| *03/12 -- 03/16* | *Spring break --- No classes!* |
| 04/10 Tu -- 04/13 Fri | **Mid-term II. Take home. No class on 04/10, but we will meet on 04/12.** |
| 05/07 -- 05/12 | **Final Exam. Take home.** |