

PHYS 5210

Graduate Classical Mechanics

Fall 2024

OVERVIEW

Lectures: 10:10-11:00 AM, MWF, Duane G2B47

Instructor: Andrew Lucas (andrew.j.lucas@colorado.edu); Duane F629.
Office hours: F 3:00-4:00 PM, M 12:00-1:00 PM

Canvas: <https://canvas.colorado.edu/courses/104229>

Books and References: Not required, but recommended for background reading.

- ▶ J. V. José and E. J. Saletan. *Classical Dynamics: a Contemporary Approach* (Cambridge University Press, 1998).

Recommended prerequisites: The standard undergraduate sequence in physics.

COURSE THEMES

- ▶ **Lagrangian mechanics** of point particles, as the natural formalism for building **effective theories**
- ▶ Noether's Theorem: **symmetries and conservation laws**
- ▶ systems with non-trivial **configuration and phase space**, such as rigid body rotation
- ▶ Lagrangian mechanics of continuous media, and **effective field theories**
- ▶ **Hamiltonian mechanics** of point particles, symmetries as **canonical transformations**
- ▶ **integrability** vs. **chaos** in Hamiltonian dynamics and discrete maps

COURSE POLICIES

- ▶ All documents are found by clicking appropriate links on the homepage of Canvas.
- ▶ Suggested reading is optional, and is posted next to each lecture on the Canvas homepage.
- ▶ Lectures will be recorded via Zoom, so long as in-person attendance is reasonable. I will not reply to messages in the Zoom chat during class if it is being held in-person.
- ▶ When I am traveling, I will try to hold class synchronously via Zoom; if this is not possible I will schedule an alternate (likely evening) time.
- ▶ Standard university policies regarding appropriate conduct on campus also apply to this class, and can be found in writing on the course website.

GRADES

- ▶ **60% homework:** Homework can be found on the course website, and on Canvas. Homework is **due at or before 11:59 PM on the due date**. Solutions will be posted on Canvas on the third day after the due date. You must upload every homework assignment electronically into Canvas. I anticipate 12-13 homework assignments in this class.

Late/drop policies: Every student starts with 3 extensions, which can be tracked in the ungraded “Extensions Left” assignment in Canvas. Extensions can be used as follows:

- ▶ To receive a no penalty 48 hour extension on the due date for a homework assignment.
- ▶ To drop a homework which was not turned in, *or* a homework which was turned in late but is (at the end of the class) below your average homework score.
- ▶ To drop a low score. (Remaining extensions will be used this way at the end of the class.)

Assuming no apocalypse, I will not give more extensions or push back deadlines. I apply these rules automatically, in the order above, so you do not need to ask for permission to use these extensions.

You can work together on homework, but you must write up your own solutions. Solutions which do not appear original could be given no credit at the discretion of course staff.

- ▶ **40% exam:** There is a 3.5 day take-home final exam (open notes, **no collaboration**) due at 11:59 PM on December 16. The exam cannot be waived.

Grade cutoffs will be chosen to avoid students being just below a cutoff. Guiding principles are:

| | | | |
|---|---------------------------------|-------------|---------|
| | grade: | A/A– | B+/B/B– |
| | curve will not be harsher than: | 90% | 60% |
| % of class that should receive at least a...: | | $\geq 40\%$ | all? |

Grades will be assigned based on a holistic method that focuses on understanding rather than algebra. Minor errors that do not reflect a lack of physical understanding will not be marked down.

Each homework/exam will be graded out of 100 points. The numbers besides each (sub)problem denote the number of points it is worth. If a (sub)problem is worth $5k$ points, you’ll receive 0, k , $2k$, $3k$, $4k$ or $5k$ points according to the holistic grading scheme. **There will always be more than 100 points that can be earned. Scores over 100 are possible.** You should expect that the last problem(s) could be very difficult (and rewarding), which is why you do not “need” to solve them to get “full credit” of 100 points.

Consequences for cheating will, at minimum, include receiving a 0 on the assignment(s) in question and a university-required referral to the Honor Code board. Further consequences may occur, at the discretion of the course instructor and graders.