PHYS 611 – Theoretical Mechanics – Fall 2019

Coordinates

The class meets Tuesdays and Thursdays, 14:00 - 15:50 in 318 Willamette.

Course website (Canvas): https://canvas.uoregon.edu/courses/141480. Lecture notes and problem sets will be posted on the Canvas site.

Instructor

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Teaching Assistant

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Description

This is a graduate course in classical mechanics, part of a two-course sequence along with PHYS 612. In this course, we will recast Newton’s laws in the language of variational principles, symmetries, and conservation laws which provide the foundation of modern physics. We will use this formalism to understand the mechanics of systems with potentially many degrees of freedom intertwined by complex constraints. In addition, the framework we develop will be applied to a variety of classical physical systems, both to connect the concepts to current research topics in physics and engineering, and to catch glimpses of how the formalism of theoretical mechanics underpins (nearly) all of fundamental and applied physics.

Course objectives

By the end of this course, students will have knowledge of the following topics in classical mechanics:
- Variational calculus applied to physical systems
- Lagrangian equations of motion
- Handling constraints
- Two-body problems: scattering, orbits
- Small oscillations, normal modes, stability analysis
- The motion of rigid bodies
- The Hamiltonian formulation of mechanics

**Materials**

There is no required textbook for the course. Material for lectures will primarily be drawn from the following textbooks, copies of which are available at the UO libraries if you would like to refer to them.

- *Theoretical mechanics of particles and continua*, A. Fetter and J. Walecka
- *Classical Mechanics*, H. Goldstein
- *Mechanics*, L. Landau and E. Lifshitz (Course of Theoretical Physics vol. 1)
- *Analytical Mechanics*, L. Hand & J. Finch
- *Mechanics*, Florian Scheck

**Coursework and evaluation**

Grades will be assigned according to the following mix:

- Problem sets: 30%
- Midterm: 30%
- Final: 40%

If it helps your grade, your score on the midterm can be replaced by your score on the final (i.e. the final will count for 70% of the grade).

Problem sets will be assigned roughly each week, typically on Tuesdays, and will be usually due at the start of class on the following Tuesday.

The midterm will be in class on Thursday, October 31.

The final will be a take-home exam, administered no earlier than Wednesday, December 11.

**Accessibility**

I take my responsibility to create inclusive learning environments seriously. Please notify me if there are aspects of this course that result in barriers to your participation. For more information or assistance, you are also encouraged to contact the Accessible Education Center, 164 Oregon Hall, 346-1155; website:
Course policies

- Cell phone use is prohibited during class. Cell phones should be silenced and put away.
- Laptops and tablets are not to be used, except for legitimate academic reasons. If you require an electronic device to take notes, you must discuss the possibility of an exception with me. If an exception is granted, use of laptops/tablets for academic reasons will be monitored throughout the term, and failure to restrict their use for this function will result in the revocation of granted privileges.
- Homework is due at the beginning of class on the due date. Late homework will not be accepted except in the case of a documented emergency.
- Collaborating on the homework is allowed and encouraged. However, you have to turn in your own work. It is up to you to make sure that you understand the material independently. You will not be able to collaborate on the exams.
- Much of the points on homework and exams will be assigned for the arguments leading up to the final answer. You will be expected to show your work and demonstrate that you understand the steps involved.
- The teaching assistant will be involved in grading your coursework. If you have any concerns about this, please discuss the matter with me.
- Make-up exams will not be given unless previously discussed.

Academic integrity

It has become quite easy to find solutions to homework problems online. Use of these solutions or similar materials is not allowed: it goes against the pedagogical purpose of graduate school, is unfair to your classmates, and violates the University Student Conduct Code (available at http://conduct.uoregon.edu).