PHYS 611 – Theoretical Mechanics – Fall 2018

Coordinates

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

Course website: https://canvas.uoregon.edu/courses/117676

Instructor

Jayson Paulose
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Teaching Assistants

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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 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

Time allowing, additional special topics may be covered, motivated in part by students’ interests.

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

I will periodically assign research articles for reading or as part of problem sets. These will be available online as long as you are on the campus network, or will be provided to you.

Coursework and evaluation

Grades will be assigned according to the following mix:

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

Problem sets will be assigned roughly every two weeks. When the course material allows it, part of the assignment may involve analyzing a journal article that uses the concepts of the course, and writing a short summary (< 1 page).

The midterm will be in class on Thursday, October 25.

The structure and timing of the final are to be announced, but it will be no earlier than Wednesday, December 5.
Accessibility

I take my responsibility to create inclusive learning environments seriously. Please notify me if there are aspects of this course that result in disability related 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: http://aec.uoregon.edu/

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. If you require an electronic device to take notes, discuss the possibility of an exception with me. Exceptions will be granted only for legitimate academic reasons. 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 assistants 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 purpose of graduate school, is unfair to your classmates, and violates the University Student Conduct Code (available at http://conduct.uoregon.edu).