PHYS 612 – Theoretical Mechanics II – Winter 2022

Coordinates

The class meets Tuesdays and Thursdays, 10:00 - 11:50 in 318 Willamette. The class will run for five weeks (last lecture Feb 3, 2022), and will be followed by PHYS 613 in the same time slot.

Course website (Canvas): https://canvas.uoregon.edu/courses/194493. Lecture notes and problem sets will be posted on the Canvas site.

Zoom information: Lectures will be streamed on Zoom upon request. Please let me know via email if you would like to attend class remotely, at least fifteen minutes before the start of the lecture.

The stream will be at https://uoregon.zoom.us/my/jpaulose.

Covid-19 policies

An addendum to this syllabus detailing University Covid-19 policies has been provided in the Course Information module on Canvas. Please read it! Course policies may be need to be adapted during the quarter to navigate pandemic-related adjustments and disruptions. Please do not hesitate to contact me if you have any concerns around navigating the class during a pandemic.

Instructor

Jayson Paulose
Office: 454 Willamette
Email: jpaulose@uoregon.edu
Student hours:

- Thursdays 15:00 - 15:45 in person (454 Willamette)
- Fridays 11:00 - 11:45 on Zoom (https://uoregon.zoom.us/my/jpaulose)
- By appointment (email me!)

Teaching Assistant

Wenqian (Saul) Sun
Office: 231 Willamette
Email: wenqians@uoregon.edu
Description

This is the second course in the graduate sequence on classical mechanics. We will build upon the framework developed in PHYS 611, again focusing on a mix of theoretical understanding and practical applications. We will further probe the structure of solutions to mechanics problems, focusing on aspects of geometry and topology of solutions in phase space. We will ask what it means for a system to be completely solvable, or integrable, at least in principle; we will then explore the behavior of chaotic systems that depart from this behavior. We will also study continuum structures using the Lagrangian formulation, and get a preview of field theory in a classical setting.

Course objectives

By the end of this course, students will have knowledge of the following topics in classical mechanics:

- Hamilton-Jacobi theory
- Action-angle variables and integrability
- Linear and nonlinear oscillators
- Dynamical stability and deterministic chaos
- Continuum mechanics of strings and pendulum chains

Materials

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.

Primary textbook: Modern Classical Mechanics, Helliwell and Sahakian

This is a modern treatment of the topic with plenty of worked examples. Readings will be posted from the textbook, and problem sets may include exercises from it. Available at the Duck Store or online. A copy has been placed on reserve at the Science Library. I have also left a copy for shared use in the Binney lounge.

Additional references:

- Theoretical mechanics of particles and continua, A. Fetter and J. Walecka
- Mechanics, L. Landau and E. Lifshitz (Course of Theoretical Physics vol. 1)
- Analytical Mechanics, L. Hand & J. Finch
- Mechanics, F. Scheck (available electronically via UO Libraries on SpringerLink)
- Mathematical Methods of Classical Mechanics, V. Arnold (available electronically via UO Libraries on SpringerLink)
Coursework and evaluation

Grades will be assigned according to the following rubric:

- Problem sets: 60%
- Final: 40%

Problem sets will be assigned roughly once a week, typically on Tuesdays, and will be usually due at the start of class on the following Tuesday. Each student gets one “late homework pass” for the course: you will be allowed to hand in one problem set up to a week late (with the understanding that you will not refer to the solutions, or discuss them with your classmates, after the solutions have been posted). All future late submissions will receive no credit, unless you have discussed any extenuating circumstances with me before the original due date.

The final will be a take-home exam similar in format to a problem set, except that you are not allowed to discuss the answers with anyone. It will be posted in Week 5 and be due in Week 6.

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: 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, except as a note-taking device.
- 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.

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).