

Computational Statistical & Thermal Physics - PHYS 320

Hunter R. Sims, PhD

hunter.sims@fmarion.edu

simsphysics.com/teaching

Office: LSF L103H, (843) 661-1445

Class Meeting Time: MWF 8:30 - 9:20 AM LSF L101

Office Hours: M–F 11:00 AM – 12:00 PM, M/TH 4:00 PM – 5:00 PM (or by appointment)

Textbook (required): *An Introduction to Thermal Physics*, Daniel V. Schroeder.

Out-of-print: ISBN 9780201380279; In-print: ISBN 9780192895547

Rule 0.

No one is born knowing how to do physics. If you are struggling, please speak with me (and/or accept my help when offered). If you are concerned that you “don’t have what it takes,” please speak with me so that I can tell you that ***that is not a real thing***.

Learning Goals

By the end of this course, the student will be able to

- Use analytical and numerical techniques to investigate processes involving heat, pressure, and entropy
- Model simple interactions and phase transitions in many-body systems
- Use molecular dynamics to model the motion of atoms and molecules

Tentative course outline

1. Energy, Heat, and Work
2. Big Numbers
3. Entropy

Computational Project 1

4. Large interacting systems
5. Heat Engines
6. Free Energy

Midterm

7. Phase Transformations
8. Boltzmann Statistics
9. The Ising Model

Computational Project 2

10. Quantum Statistics
11. Debye Theory
12. Bose-Einstein Condensates

Final

Evaluation

Grades will be determined on a standard 10-point scale, with some allowance for the variance inherent in small classes.

The final grade will be broken down in the following way

- Participation: 5%
- Homework: 10%
- Mid-term: 20%
- Computational Projects: 40% (20% each)
- Final Exam: 20%

Attendance of all sessions is expected and will be factored into Participation, but **do not come to class if you are sick** (COVID or otherwise). Absences need not be documented, **but all students are responsible for all material covered and all assignments regardless of attendance**. If you are ill (COVID or otherwise) or quarantining I will work with you to help you keep up with the course and make up work as needed. In order to do this I need to know ASAP (after deadlines have passed does not qualify as ASAP). Please be aware that you are not obligated to inform me of a positive COVID-19 test or diagnosis, but if you do so I am expected to pass that information along to the University (which you should do anyway).

Homework will generally be assigned at the beginning of each week. You must show all work and use proper units to receive full credit.

We will discuss the projects and exams as the time approaches.

Academic Integrity

All work must be the sole product of each student's brain and effort (in other words, all cheating or plagiarism will be reported and handled as detailed in the Student Handbook). For my part, I will not discriminate against any student for any reason and will make any reasonable accommodations necessary to meet a student's needs. No discriminatory or hostile behavior toward fellow students will be tolerated. If you experience or witness discriminatory, abusive, or other unwanted behavior, you should contact me, the Title IX Coordinator, and/or the Vice President for Student Affairs, as appropriate.