# PHYS 617 – Statistical Mechanics
## M W 12:00-1:15, PHYS 234

**Instructor: Prof. Paul Duffell**
Office: PHYS 326
Office Hours: Wednesday 1:30-2:30
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Graders:
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### Course Description

An overview of Statistical Mechanics, giving a statistical description of classical thermodynamics and hydrodyamics, leading into quantum statistical mechanics, the thermodynamic behavior of solids, metals, bosons and fermions. Phase transitions and condensates.

**Prerequisites:**
Undergraduate quantum and some mathematical methods would be nice, but otherwise the course will be reasonably self-contained.

Very minor programming ability will be expected (e.g. creating a loop that will do a large sum). You'll also need to be able to make plots. Python is typically the language of choice for simple projects like this (especially with the convenience of Jupyter notebooks) but you can use any language you like.

### Textbooks

No Required Text.

Main Text:
Reichl, Linda *A Modern Course in Statistical Physics*

Landau & Lifshitz also have a couple popular Stat Mech texts you might like.

### Grade System

Homework 50%
Participation 20%
Final Exam 30%

## Course Outline

The course will consist of 15 weeks of instruction, roughly (and incompletely) outlined below. This outline will be modified based on student interests and time constraints:

Week 1 – Diffusion and Entropy
Week 2 – Energy Conservation and Ideal Gases
Week 3 – Entropic Forces, Thermodynamic Potentials
Week 4 – Hydrodynamics
Week 5 – More Hydrodynamics and Entropy
Week 6 – Diffusion and Turbulence
Week 7 – Boltzmann Statistics
Week 8 – Partition Function
Week 9 – Grand Canonical Ensemble
Week 10 – Fermion Week
Week 11 – Boson Week
Week 12 – Debye Theory of Solids
Week 13 – Metals and Magnetism
Week 14 – Ising Model

## Additional Details

Homework will be assigned and turned in via Brightspace. Homework grades are mostly based on completion of all homework problems. Students are encouraged to work together to solve problems, but your final writeup should be your own work. Solutions to homework problems will be presented in-class upon request.

The participation component will be judged with modest expectations, but it is asked that students be engaged in class. If everyone is reasonably engaged and responsive, then everyone gets full participation credit.

The final exam will be given out at Purdue's scheduled final exam date. Prior to the exam, I will brief the class on the type of problems they can expect to appear on the final. I may even give out some of these problems explicitly. If I have done my job well, the final exam will contain no surprises.

Outside of class, communication will largely be handled via email. In order to receive course information in a timely manner, please check your Purdue email regularly.

**Accessibility and Accommodations**

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

**Nondiscrimination**

Purdue University is committed to providing a safe and secure campus environment for members of the university community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity.

Purdue's complete nondiscrimination policy statement can be found here:
`http://www.purdue.edu/purdue/ea_eou_statement.html`

**Mental Health Resources**

Purdue University is committed to advancing the mental health and well-being of its students. There are many options available for students to help address a wide spectrum of possible mental health concerns.

If you're struggling and need mental health services: If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

Finally, if you feel it would help you to talk to me for any reason, don't hesitate to contact me personally. Your mental health is important to me.

**Emergencies**

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

See the University's website for emergency preparedness:
`https://www.purdue.edu/ehps/emergency_preparedness/`

**Disclaimer**

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