# Syllabus

## Instructor and Logistical Information

| Class Time       | Monday 10 – 10:50 am, Willamette 110  
|------------------|-------------------------------------|  
|                  | Wednesday 10 – 10:50 am, Willamette 110  
|                  | Friday 10 – 11:50 am, Willamette 110  

**Instructor**  
Professor Tristan Ursell  
Office: 375 Willamette Hall  
Email: tsu@uoregon.edu

**Assistants**  
The graduate teaching fellows (GTF)  
- Ben Strickland – bds@uoregon.edu  
- Kentaro Hoeger – khoeger@uoregon.edu

**Email**  
We will try to respond to emails in a timely manner. Emails written in a disrespectful tone (e.g. starting with “Yo Prof Ursell”), with slang (e.g. “ur” instead of “your” or “you're”), or without full sentences will receive no response.

**Office Hours**  
**Prof. Ursell:** Monday 11am – 12pm, Willamette 375  
**Ben Strickland:** Tues 1 – 3 pm, Willamette 371  
**Kentaro Hoeger:** Monday 2 – 4 pm, Willamette 371  
Make use of office hours!

## Course Description and Materials

**Course Description**  
This course will focus on topics in statistical mechanics, employing techniques from classical mechanics, thermodynamics, and occasionally borrowing ideas from solid state physics, quantum mechanics, biophysics, and chemistry. We will use readings, discussions, and in-class problems to augment the lecture. The required mathematics will be at the level of calculus and ordinary differential equations. We will also occasionally make use of functional calculus and partial differential equations.

**Potential Topics**  
Introduction, Motivation, and Illustrations  
- Basic probability theory  
- Deriving statistical mechanics and the Boltzmann distribution from first principles  
- Equiparition Theorem / Maxwell-Boltzmann Distribution
- Two-State / Discrete-State Systems
- Simple First-order phase transitions
- Configurational Entropy
- Chemical Potential and its implications
- Fermi Distribution Function
- Bose Distribution Function
- Black Body Radiation / Stefan-Boltzmann Law
- Heat Capacity of Debye Solids
- Ising Model – 1D Exact, 2D mean field
- Second Order Phase Transitions
- Diffusion / Fick’s Law

**MATERIALS**

- You should be able to navigate the internet and make graphs (e.g. with Excel).
- In general, lectures will not be posted online, you will need to attend class to take notes.
- Readings, problems, and exam questions will come from a mixture of the book and material from Prof. Ursell.

**READINGS**

The textbook for the course is *An Introduction to Thermal Physics 1st Ed.* (available on Amazon, new and used). Other documents will be distributed online, via the course website at http://canvas.uoregon.edu.

**ASSIGNMENTS AND ASSESSMENT**

**HOMEWORK**

Homework sets are usually assigned on Wednesday and are due, in class, by the start of class the following Wednesday, unless otherwise noted (e.g. if Wednesday is a holiday). Office hours are an excellent place to discuss homework!

Homework assignments will cover topics discussed in class, and are intended to guide you in thinking further about the concepts we’re exploring. Some homework questions will be open-ended or will not have a strict right or wrong answer, but will depend on the clarity of your logic and analysis. The goal is to get you thinking using concepts from class rather than rote regurgitation of class material.

Your responses will typically be submitted on paper. You are encouraged to discuss homework assignments and readings with others, though your final answers should be your own – direct copying is not allowed, and evidence of such will result in a 0% score on the offending homework. **Anticipate spending at least 8 solid hours per week on homework.**

**GRADING**

The grading scheme for this course will be simple. Each week there will be a challenging problem set that will comprise 70% of your total grade, approximately 9 homework sets in total. I will drop the lowest homework grade
from your average. There will be short in-class quizzes scattered throughout the term, roughly one every other week – each quiz will be worth about 3% of your grade (for a total of ~15% of your grade). There will be a final exam worth 15% of the course grade. Prof. Ursell reserves the right to modify this grading scheme, including the number and type of assignments and exams, as necessary.

<table>
<thead>
<tr>
<th>IN-CLASS WORK</th>
<th>Students will often tackle equation-based problems in small groups and discuss their results with the class.</th>
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<tbody>
<tr>
<td>GRADING SCALE</td>
<td>The course grading scale is roughly: A=90-100%; B=80-89.9%; C=70-79.9%; D=60-69.9%; F&lt;60%. Depending on the distribution of grades, a curve / slide may be (usually is) applied.</td>
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**OTHER INFORMATION**

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<tr>
<th>ABSENCES</th>
<th>I realize that students will miss a few classes (due to illness, for example). Assignments are based heavily on what we cover in class and readings, and it is your responsibility to ensure you have the notes and preparation you need. That said, office hours are a good time to make sure you are tracking with class material and to get help with homework.</th>
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<tbody>
<tr>
<td>LAPTOP AND CELLPHONE POLICY</td>
<td>At no point are cell phones to be used in class, <strong>put them on airplane mode before coming into class</strong>. I have no tolerance for this and I will call you out. The use of laptop computers in class is not allowed. Why? Several studies, plus past experience, show that students using laptops in class spend a great deal of time on non-class-related activities (surfing the web, playing games, Facebook, etc) and that these distractions negatively impact both learning and grades. This alone isn’t a reason to ban laptops – you’re responsible for your own performance in class. In addition, however, studies have shown that non-class-related laptop use distracts and impacts the learning of other students nearby. (e.g. see Fried, C. B. <em>Computers &amp; Education</em> <strong>50</strong>, 906-914 (2008)). Plus, students have complained about the environment created by their classmates’ laptop usage. Incidentally, taking notes by hand is more effective at cementing concepts in your mind, than blithely following along on a screen. In summary, laptops are not allowed in class. The only exceptions will be for people with documented medical needs; please see me if this is the case.</td>
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<tr>
<td>NECESSARY CAVEATS</td>
<td>Students are expected to abide by university policies on academic honesty, avoiding plagiarism, fabrication, cheating, and academic misconduct. The Student Conduct Code (<a href="http://conduct.uoregon.edu/">http://conduct.uoregon.edu/</a>) provides definitions of these terms and explanations of the university policy on the subject. The UO Library also provides a guide to avoiding plagiarism (<a href="http://libweb.uoregon.edu/guides/plagiarism/students/">http://libweb.uoregon.edu/guides/plagiarism/students/</a>). You are responsible for understanding these regulations and abiding by them. Academic dishonesty will be dealt with severely, as it is disrespectful to your fellow students and your instructor, as well as being against both</td>
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university regulations and state laws. If you are questioning the integrity of what you’re doing, it probably falls under the umbrella of academic dishonesty. If you have questions or concerns, come see me.

**Musical Chairs**

Interacting with a diverse array of your fellow students in class throughout the term is essential and instructive. However, the behavior of students who spend too much time together can develop into distraction for themselves and those sitting around them. As such, each week, you will choose a different seat in class, importantly, with different neighbors.

**Students Needs**

If there are aspects of the instruction or course design that result in barriers to your inclusion, please notify Prof. Ursell as soon as possible. You are also welcome to contact Disability Services in 164 Oregon Hall, 541-346-1155.

Some assignments and assessments may require use of a computer / laptop. The Allen Science Library (right next to Willamette Hall) has nice desktop computers available for use, and the Knight Library has a free laptop loaner program.

**Policy on Missed Deadlines, Significant Absences, Incompletes, and Snow Days**

Only the following unforeseen and uncontrollable emergency situations are acceptable excuses for missed deadlines:
- Documented serious illness/injury;
- Documented death in the immediate family.

All of the following are **unacceptable** – note that they include “personal” as well as “technological” excuses:
- Special occasions (e.g. weddings, birthdays, anniversaries etc.)
- Work and school conflicts: “I had to work extra hours,” “I have a huge midterm tomorrow in another class…”
- Couldn’t get to campus (alarm didn’t ring; missed the bus; etc.)
- Being generally “busy” or having “a lot going on right now…”
- Forgot or “mixed up” the assignment or due date
- No access to computer or printer; assignment completed on computer is “missing,” was accidentally erased, or is inaccessible

If a class is canceled due to external factors (e.g. inclement weather), we will have a makeup class at a suitable date and time.

**Succeeding in This Course**

**Plan ahead and start early!** The reading assignments are a vital part of this course, and it is important to start reading them early not only to understand the subject matter but also to be able to articulate what you don’t understand – in class lectures and discussions will build on your reading experiences. Note that the reading assignments must be done **before** the days at which their topics are discussed in lecture. In general, it will be crucial to keep up with the course and not fall behind; later topics will build on earlier ones.
**Make use of resources.** If you have questions about lectures, assignments, readings, or other matters, please visit Prof. Ursell during office hours, or communicate by email. Individual appointments can be arranged to accommodate schedule conflicts with the regular office hours.