Syllabus, Statistical Mechanics Phys 5163, Spring 2022
University of Oklahoma, College of Arts and Sciences

- Instructor: Doerte Blume (she/her/hers).
- Class: MW, 10.30am-11.45am, Nielsen Hall 0302.
  Consistent with OU policy (as of the writing of the syllabus), I expect that you wear a mask in class unless medical or other reasons prevent you from doing so.
- How to contact me?
  Office hours: Thursdays, 10.15-11.45am and 2.30-3.30pm. Office: 214 Lin Hall.
  Email: doerte.blume-1@ou.edu.
  Please reach out: You are encouraged to stop by my office (knock on my door; if I'm busy you will have to make an in-person or Zoom appointment) or to send me an email. Unless the pandemic situation changes drastically, I expect that you wear a mask when coming to office hours. If this does, for some reason, not work for you, then I ask that you please contact me for Zoom office hours (just send me an email and we will arrange a time that works for both of us).
- There will be a total of 9 HW assignments. Assignments will be posted on Canvas, typically at least a week before solutions are due. Homework assignments are due on Fridays at 6pm. In general, late HW solutions will not be accepted, unless there is a documented medical reason or other emergency. If there happen to be multiple competing time demands in a particular week, an extension for the entire class can be negotiated; however, this should be the exception and not the rule. If you are falling behind with class related work, I encourage you to come and talk to me.
  Homework solutions should be uploaded to Canvas in their "natural order" (Problem 1 first, Problem 2 second, and so on).
  Each assignment contains four problems and each problem carries a weight of 1 point.
  If directions are given on the assignment, please follow the directions.
  You are encouraged to discuss the course content, lectures, and homework assignments with your peers; the emphasis in these discussions should lie on deepening your understanding of the material and enhancing your problem solving skills (by asking questions, by explaining your understanding to your peers, etc.). It is important that you write up the homework solutions on your own. Your HW solutions should be written up such that the grader/instructor can easily follow your logic; this means that equations need to be complemented by explanatory text (a solution that just contains equations and no discussion of what the equations mean will be given a zero).
  If you are using a reference other than the textbook/lecture notes, please indicate so.
  Tentative schedule:
  - Solutions to HW assignment 1 are due on Fr., 01/28/2022.
  - Solutions to HW assignment 2 are due on Fr., 02/04/2022.
  - Solutions to HW assignment 3 are due on Fr., 02/11/2022.
  - Solutions to HW assignment 4 are due on Fr., 02/18/2022.
  - Solutions to HW assignment 5 are due on Fr., 03/04/2022.
  - Solutions to HW assignment 6 are due on Fr., 03/25/2022.
  - Solutions to HW assignment 7 are due on Fr., 04/01/2022.

  - Solutions to HW assignment 8 are due on Fr., 04/15/2022.
  - Solutions to HW assignment 9 are due on Fr., 04/29/2022.

- Solutions to the HW assignments will be posted on Canvas. Please check your solutions against the solutions provided.

- Dates to note:

  - No class on 03/14/2022 and 03/16/2022 (Spring break).

- There will be three exam:

  - Exam 1: 2.5-hour exam on Thursday, 02/24/2022, or Friday, 02/25/2022.
  - Exam 2: 2.5-hour exam on Thursday, 04/07/2022, or Friday, 04/08/2022.
  - Exam 3: Take-home exam/paper. Due on Tuesday, 05/10/2022.
  - The dates and times for the Exam 1 and Exam 2 will be determined during the second week of class. Once the exam dates/times are announced, please inform the instructor far in advance (at least two weeks) of any time conflicts due to, e.g., TA duties regarding the exam times/dates.

- Your grade will be determined as follows:

  - Percentages:
    * Best 8 HW assignments (out of 9 HW assignments): 35%.
    * Exam 1: 17.5%
    * Exam 2: 22.5%
    * Exam 3: 25%
  - Grades are correlated with competency in the following manner:
    * A grade of "A" indicates that the student has demonstrated strong competency of the graduate material covered in the class.
    * A grade of "B" indicates that the student has demonstrated essential competency of the graduate material covered in the class.
    * A grade of "C" indicates that the student has demonstrated rudimentary competency of the graduate material covered in the class.
  - You are invited and encouraged to discuss your standing in the course with the instructor at any time during the semester.

- Course goals/topics:
  Understanding of ensembles and thermodynamics, fluctuations, monatomic crystals, ideal gases, phase equilibrium, chemical equilibrium in ideal gas mixtures, ideal gas in an electric field, Bose-Einstein and Fermi-Dirac statistics, blackbody radiation, electrons in metals.

- Tentative schedule (the content of Chapters 1 and 2 of the textbook will be integrated into the discussion of Chapters 6-8):

  - Chapter 6 of textbook: Classical Statistical Mechanics (about 3 lectures).
  - Chapter 7 of textbook: Canonical Ensemble and Grand Canonical Ensemble (about 3 lectures).

- Chapter 8 of textbook: Quantum Statistical Mechanics (about 3 lectures).
- Chapter 10 of textbook: Approximate Methods (about 2 lectures).
- Chapter 11 of textbook: Fermi Systems (about 4 lectures).
- Chapter 12 of textbook: Bose Systems (about 2 lectures).
- Aspects of Chapter 14 of textbook: Ising Model; Chapter 16: Critical Phenomena; Chapter 17 of the textbook: The Landau Approach; Chapter 18 of the textbook: Renormalization Group (about 2 lectures).
- Chapter 3 of textbook: The Problem of Kinetic Theory (about 2 lectures).
- Chapter 4 of textbook: The Equilibrium State of a Dilute Gas (about 2 lectures).
- Chapter 5 of textbook: Transport Phenomena (about 1 lecture).

- Textbook:
"Statistical Mechanics", second edition, by Kerson Huang, Wiley, ISBN 978-0471815181.
Other books that I contemplated using as a textbook and that the material covered will draw from:
  - "Statistical Mechanics", third edition, by R. K. Pathria and Paul D. Beale, Academic Press, ISBN 978-0-12-382188-1.
  - "Statistical Mechanics" by Donald A. McQuarrie, University Science Books, ISBN 1-891389-15-7.
  - "Thermodynamics and an introduction to thermostatistics", second edition, by Herbert B. Callen, Wiley, ISBN 0-471-86256-8.

- The website $https://www.ou.edu/cas/physics-astronomy/cic/resources/general$ lists resources, including links to OU Advocates, OU Support, OU Reporting Hotline, OU Equity Office, OU Diversity and Inclusion, OU Disability Resources, GEC, Veteran Support, Marginalized Community Support, Campus Safety, and Off-Campus Support. It is a good idea to familiarize yourself with these and/or other resources—there might be a time when you or someone you know is in a situation where they might benefit from one or more of these resources.

- Land Acknowledgement Statement (provided by OU's Tribal Liaison office):
Long before the University of Oklahoma was established, the land on which the University now resides was the traditional home of the "Hasinais" Caddo Nation and "Kirikir?i:s" Wichita and Affiliated Tribes. We acknowledge this territory once also served as a hunting ground, trade exchange point, and migration route for the Apache, Comanche, Kiowa and Osage nations. Today, 39 tribal nations dwell in the state of Oklahoma as a result of settler and colonial policies that were designed to assimilate Native people. The University of Oklahoma recognizes the historical connection our university has with its indigenous community. We acknowledge, honor and respect the diverse Indigenous peoples connected to this land. We fully recognize, support and advocate for the sovereign rights of all of Oklahoma's 39 tribal nations. This acknowledgement is aligned with our university's core value of creating a diverse and inclusive community. It is an institutional responsibility to recognize and acknowledge the people, culture and history that make up our entire OU Community.

- University policies:

– Academic integrity:
Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at $http://integrity.ou.edu/students\_guide.html$. To be successful in this class, all work on the exam must be yours and yours alone. You may not receive outside help. On exams you are not permitted to use any aids other than those listed on the exam. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so do not cheat. It is simply not worth it.

– Religious observance:
It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

– Reasonable accommodation policy:
Students seeking academic accommodation should contact the Accessibility and Disability Resource Center for assistance at (405) 325-3852 or TDD: (405) 325-4173. For more information please visit
$http://www.ou.edu/drc/home.html$. Any student in this course who has a disability that may prevent them from fully demonstrating their abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

– Title IX resources and reporting requirement:
For any concerns regarding gender-based discrimination, sexual harassment, sexual assault, dating/domestic violence, or stalking, the University offers a variety of resources. To learn more or to report an incident, please contact the Sexual Misconduct Office at 405/325-2215 (8 to 5, M-F) or smo@ou.edu. Incidents can also be reported confidentially to OU Advocates at 405/615-0013 (phones are answered 24 hours a day, 7 days a week). Also, please be advised that a professor/GA/TA is required to report instances of sexual harassment, sexual assault, or discrimination to the Sexual Misconduct Office. Inquiries regarding non-discrimination policies can be directed to University Equal Opportunity Officer and Title IX Coordinator at 405/325-3546 or smo@ou.edu. For more information, visit $http://www.ou.edu/eoo.html$.

– Adjustments for pregnancy/childbirth related situations:
Should you need modifications or adjustments to your course requirements because of a documented pregnancy-related or childbirth-related situation, please contact your professor or the Disability Resource Center at 405/325-3852 as soon as possible. Also, see
$http://www.ou.edu/eoo/faqs/pregnancy-faqs.html$ for answers to commonly asked questions.

– Final exam preparation period:
Pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions

of the policy please refer to OU's Final Exam Preparation Period policy (*https* : *//apps.hr.ou.edu/FacultyHandbook#*4.10).

- Emergency protocol:
  During an emergency, there are official university procedures that will maximize your safety. Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather 1. LOOK for severe weather refuge location maps located inside most OU buildings near the entrances 2. SEEK refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building. 3. GO to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows. 4. GET IN, GET DOWN, COVER UP. 5. WAIT for official notice to resume normal activities.
- Armed subject/campus intruder:
  If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots: 1. GET OUT: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911. 2. HIDE OUT: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. 3. TAKE OUT: As a last resort fight to defend yourself. For more information, visit *http* : *//www.ou.edu/emergencypreparedness.html*.
- Fire alarm/general emergency:
  If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates: 1. LEAVE the building. Do not use the elevators. 2. KNOW at least two building exits 3. ASSIST those that may need help 4. PROCEED to the emergency assembly area 5 ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues. 6. WAIT for official notice before attempting to re-enter the building.
- Mental health support services:
  If you are experiencing any mental health challenges that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). The Center is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call (405) 325-2911. For more information, please visit *http* : *//www.ou.edu/ucc*.