

# Syllabus

**Course Title:** Statistical Physics

**Course Number:** PHY 4523

**Credit Hours:** 4

**Pre-requisites:** Survey of Modern Physics (PHY 3103C)

**Recommended Courses:** Classical Mechanics (PHY 3221), Electromagnetism 1 (PHY 3323), and Quantum Mechanics 1 (PHY 4604)

**Term:** Spring 2016

**Class Location and Time:** SE 101, MW 4:00 PM-5:50 PM

**Instructor:** Dr. Andy Lau

Office: SE 442

Office Hours: MW 2:00- 4:00 pm

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**Course Description:** This course is an introduction to the statistical mechanics and thermodynamics of macroscopic systems in equilibrium. It develops various ensemble theories and uses them to study the physical properties of classical and quantum ideal gases, crystals, magnetic materials, and systems in chemical equilibrium.

**Course Objectives:** After completion of the course, a student should have a broad exposure to the conceptual, as well as the mathematical, formulation of statistical mechanics and its applications. The course is also designed to train students to solve physics problems (creatively), and to build in the student a sense of mathematical competence.

## Course Topical Outline:

Week 1: Introduction to statistical physics

Week 2-3: Introduction probability theory

Week 4-5: Ideal Gas Law; Maxwell-Boltzmann distribution

Week 6: Brownian motion; Einstein relation

Week 7: The 1<sup>st</sup> and 2<sup>nd</sup> law of thermodynamics, and their applications

Week 8: Foundation of statistical mechanics; micro-canonical ensemble

Week 9-10: The canonical ensemble and its application; classical ideal gas

Week 11: Stability, fluctuation, and response of a macroscopic system in equilibrium

Week 12-13: The grand canonical ensemble and ideal quantum gases

Week 14-15: Phases and phase transitions

**Method of Instruction:** The format of the course will be lectures, reading assignments, and homework assignments.

**Grading Procedure:** Final grade will be decided from (1) scores from weekly homework assignments [20%], (2) a midterm exam [20%], (3) a cumulative final exam [20%], and (4) a 20 minutes presentation (during the end of the semester) on a topic of student's choice, but it must be related to statistical physics [40%].

**Grading:** A: 100-93%    A-:92-89%    B+: 88-85%    B: 84-80%    B-: 79-76 %  
C+:75-72%    C: 71-68%    C-:67-65%    D+:64-60%    D: 59-56%  
D- : 55-50%    F: <50%.

**Policy on make-up tests and late work:** If a student cannot attend an exam or hand in homework on time because of a legitimate problem, for example, because of a significant health, he or she can make up the respective assignment.

**Required Text:** F. Mandl, *Statistical Physics*, 2<sup>nd</sup> Edition. If supplementary material is needed, this will be distributed in class.

**Supplementary Text:** Landau and Lifshitz, *Statistical Physics* 3<sup>rd</sup> edition, part 1.

**Classroom etiquette policy:** University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions."

**Disability Policy Statement:** In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) - in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799- 8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

**Honor Code Policy Statement:** Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at [http://www.fau.edu/ctl/4.001\\_Code\\_of\\_Academic\\_Integrity.pdf](http://www.fau.edu/ctl/4.001_Code_of_Academic_Integrity.pdf)