UNIVERSITY OF CALGARY
DEPARTMENT OF PHYSICS AND ASTRONOMY
COURSE INFORMATION SHEET

1. Course: **Physics 611, Statistical Physics**

Lecture/Time/Session(s): L01: TR, 11:00-12:15, SS 105, Fall 2009

Instructor(s): Dr. J. Davidsen

Office: SB 505, 403-210-7964
Office Hours: W 15:00 – 16:00
Email: joern.davidsen@ucalgary.ca
Physics and Astronomy Office: SB 605, 403-220-5385

2. Prerequisites: It is expected that a student's background will include Physics 449 or equivalent.

Note: The Faculty of Science policy on pre- and co-requisite checking is outlined on page 203, columns 2 and 3 of the 2009-2010 Calendar. A student may not register in a course unless a grade at least" C-"has been obtained in each pre-requisite course; it is the responsibility of students to ensure that their registrations are in order.

3 The University policy on grading and related matters is described on pages 41-53 of the 2009 - 2010 Calendar. In determining the overall grade in the course the following weights will be used:

Assignments	35%
Midterm Examination	25%
Final Examination	40%

4. Missed Components of Term Work. The regulations of the Faculty of Science pertaining to this matter are outlined on page 204, column 1 of the 2009-2010 Calendar. It is the student's responsibility to familiarize himself/herself with these regulations.

Assignments: Assignments must be handed in on time. Late assignments will not be marked, unless circumstances such as illness prevent a student from meeting the deadline.

TEXTBOOK: ***"Statistical Physics of Particles",*** Mehran Kardar, Cambridge University Press

Department Approval: _____ Date: _____

IMPORTANT/SAFEWALK: Campus Security will escort individuals day or night. Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under the heading "Student Misconduct (pages 49-53 for 2009-2010).

FOIP: This course will be conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page.

STUDENT UNION INFORMATION: VP Academic **Phone**: 220- 3911 **Email**: suvpaca@ucalgary.ca
SU Faculty Rep. **Phone:** 220 3913 **Email:** sciencerep@su.ucalgary.ca

JD/clh
13-8-09

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13-8-09

Physics 611, Statistical Physics   Fall 2009

Catalog description: Classical and quantum ensemble theory applied to interacting systems: real gases, spin lattices, phase transitions. Kinetic theory: Boltzmann equation, transport processes, irreversible processes and fluctuations.

Course Content

1. Probability theory: random variables, probability distributions, central limit theorem, rules for large numbers, information & entropy, maximum entropy principle

2. Kinetic theory: phase space density, Liouville's theorem, ergodicity & mixing, BBGKY hierarchy, Boltzmann equation, H-theorem & irreversibility

3. Classical Statistical Mechanics: microcanonical ensemble, two-level systems & negative temperature, ideal gas, mixing entropy & Gibbs paradox, canonical ensemble, grand canonical ensemble

4. Interacting systems: cumulant expansion, cluster expansion, van der Waals equation

5. Quantum Statistical Mechanics: dilute polyatomic gas, vibrations of a solid, black body radiation, quantum microstates, quantum macrostates, density matrix, quantum ensembles

6. Ideal quantum gas: identical particles, canonical formulation, grand canonical formulation, non-relativistic gas, degenerate Fermi gas, degenerate Bose gas, Bose-Einstein condensation

7. Introduction to phase transitions and critical phenomena (time permitting): Ising model, transfer matrix method, mean-field theory, Landau theory, Yang-Lee theory

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In addition to our textbook, the following are useful reference books:

1. H.B. Callen. Thermodynamics and an Introduction to Thermostatistics, 2d ed., Wiley (2001). ISBN-10: 0471862568.
2. Morikazu Toda, Ryōgo Kubo, Nobuhiko Saitō: Statistical physics, Springer, 1991. ISBN 3540536620, 9783540536628.
3. Huang, Kerson. Statistical Mechanics. 2nd ed. New York, NY: Wiley, 1987. ISBN: 0471815187.
4. Pathria, R. K. Statistical Mechanics. New York, NY: Pergamon Press, 1984. ISBN: 0080189946.
5. Ma, Shang-keng. Statistical Mechanics. Translated by M. K. Fung. Philadelphia, PA: World Scientific, 1985. ISBN: 9971966069 (Singapore).
6. Landau, L. D., and E. M. Lifshitz. Statistical Physics. Part 1. 3rd ed. New York, NY: Pergamon, 1980. ISBN: 0080230385.
7. Reif, Frederick, ed. Fundamentals of Statistical and Thermal Physics. New York, NY: McGraw-Hill, 1965.
8. Feynman, Richard Phillips. Statistical Mechanics. Reading, MA: Addison-Wesley, 1998. ISBN: 0201360764.
9. Stanley, H. Eugene. Introduction to Phase Transitions and Critical Phenomena. New York, NY: Oxford University Press, 1971. ISBN: 0195014588.
10. Negele, John W., and Henri Orland. Quantum Many-particle Systems. Redwood City, CA: Addison-Wesley Pub. Co., c1988. ISBN: 0201125935.
11. Reichl, Linda E. A Modern Course in Statistical Physics. 2d ed., Wiley (1998). ISBN-10: 0471595209.
12. Michael Plischke, Birger Bergersen: Equilibrium Statistical Physics, World Scientific, 2005. ISBN 9812560483, 9789812560483.

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There will be one midterm examination in late October to early November. Homework assignments will typically be handed out on Thursdays and are due the following Thursday before class. All course related material will be posted on Blackboard.

Important dates for Fall 2009

Tu 8-09	Lectures begin.
M 21-09	Last day to change registration
M 12-10	Thanksgiving Day – University Closed
W 11-11 to Su 15-11	Reading Days
Tu 08-12	Lectures end.
F 11-12 to M 21-12	Final Exam period.