PHYS 4400 Statistical Mechanics Winter 2019

Instructor: Stefan Wallin, office C1061, phone 864-8880, email swallin@mun.ca

Classes: Mon, Wed and Fri 12:00-12:50, Room C3067.

Desire2Learn: We will use D2L (Brightspace) for course information, grades, supplemental information, etc.

Course book: *Introduction to Modern Statistical Physics* by David Chandler (1987). Oxford University Press. There will also be some handouts to supplement the course book.

Pre/co-requisites: PHYS 3400 and 3750 (if you are interested but do not have 3750, contact to me).

Course outline: We will cover chapters 1-5 of the course book:

Chapter 1. Thermodynamics, fundamentals (~2 weeks). *Laws of thermodynamics, variational statement of second law, Legendre transforms, Maxwell relations, Gibbs-Duhem equation.*

Chapter 2. Conditions for equilibrium and stability (~2 week). *Multiphase equilibrium, Stability, Gibbs phase rule, plane interfaces.*

Chapter 3. Statistical Mechanics (~2 weeks). *Statistical ensembles (microcanonical, canonical, grand canonical), Gibbs entropy formula, fluctuations.*

Chapter 4. Non-interacting (ideal) systems (~2 weeks). *Photon gas, phonon gas, occupation numbers, classical limit, dilute gas of diatomic atoms, chemical equilibria.*

Chapter 5. Statistical mechanical theory of phase transitions (~3 weeks). *Ising model, lattice gas, mean field theory, broken symmetry, renormalization group theory.*

Time permitting: Selected parts of Chapters 6 (Monte Carlo method) and Chapter 8 (Non-equilibrium statistical mechanics).

Problem sessions: Much of the course material will be worked out through exercises. We will therefore have weekly problems sessions (mostly Fridays). You should prepare for each session by solving (or seriously attempting) the assigned exercises. You will be called upon to solve/discuss exercises in class. The focus will be on understanding the methods and concepts used to solve the problems, rather than getting the right answer.

Seminars: Seminars will be carried out as round-table discussions. You are required to carefully read and engage with the assigned sections of the textbook before each seminar. *Come prepared with (1) minimum 1-2 pages of notes where you summarize the assigned sections in your own way; and (2) several questions (minimum 3) on the text: Which statements/equations/arguments/assumptions/approximations do you find difficult to understand? What do you find especially interesting? What are you confused about? What connections can you make with other previous sections?* There will be one seminar per week (often Mondays). At the beginning of each seminar, one student is selected (randomly) to informally present the material and to lead the discussion.

Assignments: Problem sets to be handed in for grading (~3). Assignments could contain computational components.

Evaluation:

Problem sessions (weekly)	13%	
Seminars (weekly)	13%	
Assignments (~3)	15%	
Midterm test (50 min)	19%	(mid February)
Final exam (3 hour)	40%	

Supplemental final exam will not be allowed.

Important general information from the University.
It is the student's responsibility to acquaint themselves with these items. Please read.

3. Student Code of Conduct.
http://www.mun.ca/student/conduct/

6.8.2 Exemptions From Final Examinations
http://www.mun.ca/regoff/calendar/sectionNo=REGS-0628

6.12 Academic Misconduct
http://www.mun.ca/regoff/calendar/sectionNo=REGS-0748

Accommodations for Students with Disabilities
http://www.mun.ca/blundon/accommodations/