Phys 559 Advanced Statistical Mechanics

Fall 2018

Time: Mon., Wed., Fri. 8:35-9:25 **Room:** WONG 1050

Course content on myCourses: http://www.mcgill.ca/mycourses/

Lecturer: Lenin Del Rio Amador (delrio@physics.mcgill.ca; http://www.physics.mcgill.ca/~delrio/)

TA: Sigtryggur Hauksson (sigtryggur.hauksson@mail.mcgill.ca)

Course Outline

1. Main ideas in Probability, Random Variables and Stochastic Processes; Review of Statistical Mechanics concepts; Independence, self-averaging, and Gaussian distributions; Review of thermodynamics.
2. Information theory; Maxwell's demon; channel capacity; quantum information.
3. Fluctuations about equilibrium; Broken symmetries and correlation functions; Goldstone's theorem.
4. Ising model, mean-field theory, Landau theory, Ornstein-Zernicke theory of fluctuations.
5. Scaling and the renormalization group; real-space renormalization group (block spins); recovering the ferromagnetic phase diagram; momentum-space renormalization group.

Basic Textbooks

Part of this class will follow a set of notes by Martin Grant and William Coish. Notes will be posted regularly in myCourses and usefull content can be downloaded from:

http://www.physics.mcgill.ca/~delrio/courses/phys559.html

Principles of Probability theory will follow the book by Athanasios Papoulis, listed below.

Topics 4 and 5 above will be taught primarily from the book by Nigel Goldenfeld, listed below.

The following textbooks may be useful and provide supplementary information:

- A. Papoulis, "Probability, Random Variables and Stochastic Processes". (McGraw-Hill, New York, 1984).
- N. Goldenfeld, "Lectures on Phase Transitions and the Renormalisation Group". (Addison-Wesley, Reading, Mass., 1992).
- P. M. Chaikin and T. C. Lubensky, "Principles of Condensed Matter Physics". (Cambridge University Press, New York, 1995).
- L. D. Landau and E. M. Lifshitz, "Statistical Physics 3rd Edition Part 1". (Elsevier, Amsterdam, 1980).
- S.-K. Ma, "Statistical Mechanics". (World Scientific, Philadelphia, 1986).

Grading Policy

Mid-term exam	20 %
Final exam	50 %
Assignments	30 %

Rights/Responsibilities

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information).

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Instructors who may adopt the use of text-matching software to verify the originality of students' written course work must register for use of the software with Educational Technologies (Email) and must inform their students before the drop/add deadline, in writing, of the use of text-matching software in a course.

Additional Information

1. Instructor

Instructor:	Lenin Del Rio Amador
Office:	Rutherford 207
web page:	http://www.physics.mcgill.ca/~delrio/
E-mail:	delrio@physics.mcgill.ca
Office Hours:	Monday, 9:30 - 10:30, or by appointment.

2. Assignments

   - All problem sets are due in class on the date specified. There will be no credit for handing in late assignments.

3. Exams

   - Exam schedule:

Mid-term	2018 Oct. 17 (Wednesday)	8:35-9:25 (in class)
Final Exam	TBA	

   - All exams will be "open book" exams.
   - The mid-term exam will be held during the normal class period.
   - The final exam is cumulative,and will be three hours long.

4. Scheduling

   - The last lecture will be on Tuesday, Dec. 3 at 8:35 - 9:25, following the Monday schedule.