EPFL

MATH-486 | **Statistical mechanics and Gibbs measures**

Friedli Sacha

Cursus	Sem.	Type
Data Science	MA2, MA4	Opt.
Ing.-math	MA2, MA4	Opt.
Mathématicien	MA2	Opt.
SC master EPFL	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Oral
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course provides a rigorous introduction to the ideas, methods and results of classical statistical mechanics, with an emphasis on presenting the central tools for the probabilistic description of infinite lattice systems.

Content

The goals of this course are to present

- the probabilistic description of large systems with interacting components,

- the mathematical description of phase transitions occuring in certain discrete models (Curie-Weiss, Ising model, Gaussian Free Field, systemswith continuous symmetries, etc.)

- the general theory of infinite-volume Gibbs measures (the so-called Dobrushin-Lanford-Ruelle approach)

If times permits, and depending on the interest of the participants, we consider the peculiar properties of certain models with an underlying continuous symmetry (Gaussian free field, Mermin-Wagner Theorem for O(n) models).
This course is companion to the course ``lattice models'', where discrete models
are also considered, but with an emphasis on different aspects.

The lectures will be largely based on the book *Statistical mechanics of lattice systems; a concrete mathematical introduction*, by S. Friedli and Y. Velenik (Cambridge University Press, 2017)

Keywords

statistical mechanics, phase transitions, Gibbs measures, entropy, Ising model, Gaussian Free Field

Learning Prerequisites

Required courses

- Analyse 1et 2
- Théorie de la Mesure
- Probabilités

Assessment methods

Examen oral.

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	No
Assistants	No
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Statistical mechanics of lattice systems; a concrete mathematical introduction, by S. Friedli and Y. Velenik (Cambridge University Press, 2017)
Gibbs Measures and Phase Transitions, by H.-O. Georgii (De Gruyter Studies in Mathematics Vol. 9. Berlin: de Gruyter 1988)

Ressources en bibliothèque

- Gibbs Measures and Phase Transitions / Georgii
- Statistical mechanics of lattice systems / Friedli & Velenik
- (electronic version)

Websites

- http://www.unige.ch/math/folks/velenik/smbook/