MATH-426	**Gaussian processes**		
	Aru Juhan		

Cursus	Sem.	Type
Ing.-math	MA2, MA4	Opt.
Mathématicien	MA2	Opt.

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

Summary

This is an introductory course on Gaussian processes. By discussing both the general theory and concrete examples, we will try to understand where and how Gaussian processes appear, and how to study them.

Content

This course serves as an introduction to the world of Gaussian processes. Gaussian processes are omnipresent in modelling random phenomena. There are at least two reasons for it:

1) Gaussian processes appear naturally through the Central Limit Theorem and its relatives;
2) Gaussian models have many special properties that make their mathematical study interesting...and possible.

The aim of this course is to better understand these two reasons by both looking into general properties of Gaussian measures, and by studying in detail some concrete Gaussian models.

Here is a tentative list of topics:

- Different characterisations of standard Gaussians and revisiting the Central Limit Theorem;
- Basic properties of finite-dimensional Gaussian measures (including marginal laws, conditional laws, Cameron-Martin shifts);
- High-dimensional Gaussian processes and the concentration of measure phenomenon (some version of Borell-TIS inequality and Dudley entropy bound);
- Existence and constructions of infinite-dimensional Gaussian processes and their basic properties;
- Some of the models potentially discussed: Gaussian random matrices, the Random Energy Model, the Discrete Gaussian free field; Gaussian process regression; Brownian motion/bridge.

Learning Prerequisites

Required courses

Mathematics Bachelor's level knowledge of analysis, linear algebra and probability (for example, the Bloc "Science de Base" in EPFL Mathematics Bachelor's program).

Recommended courses

From the Bachelor's program: Martingales and applications; Stochastic processes;
From the Master's program: Probability theory, Theory of Stochastic calculus.

Learning Outcomes

By the end of the course, the student must be able to:
- Recognize Gaussian processes
- Characterize Gaussian processes
- Analyze Gaussian processes

Teaching methods

Lectures and exercise classes.

Assessment methods

During the semester
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	Yes
Forum	No

Resources

Bibliography

Will be discussed in class.