EPFL

MSE-213   **Probability and statistics for materials science**

Moll Philip

Cursus	Sem.	Type
Materials Science and Engineering	BA4	Obl.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

The students understand elementary concepts of statistical methods, including standard statistical tests, regression analysis and experimental design. They apply computational statistical methods to analyse larger data sets.

Content

• **Basic statistics and probability theory.** Introduce concepts of uncertainty, random variables, probability distributions and apply them to examples from materials science.

• **Statistical testing of hypothesis**. Formulate hypothesis and test them on data sets in the presence of statistical uncertainty. Identify in real-life problems which methods to apply.

• **Assess the limitations of statistics.** Develop the skill to interpret a given statistical analysis, and critically assess the validity of its conclusion.

• **Computational analysis in R**. Introduction into the basic aspects of the statistical programming language R. Construct hypotheses and perform associated statistical tests on large sets of data.

Keywords

Statistics, Probability, big data, experimental design, R

Learning Prerequisites

Important concepts to start the course

• Basic concepts of programming
• Basic calculus and matrix calculations

Learning Outcomes

By the end of the course, the student must be able to:

• Examine the conclusions of a given statistical analysis.
• Use the method of least squares
• Define random variables, probability distributions, the central limit theorem and the law of big numbers.
• Analyze a population according to the ANOVA method.
• Perform a Student Test.
• Implement statistical methods computationally using R-code.

Transversal skills

- Take account of the social and human dimensions of the engineering profession.
- Access and evaluate appropriate sources of information.

Teaching methods

Lectures combined with exercises to solve computational examples.

Expected student activities

Attendance of lectures and solving of exercises on the computer. A laptop computer will be required for this course.

Assessment methods

written exam

Supervision

Assistants   Yes

Resources

Virtual desktop infrastructure (VDI)
No

Bibliography

Introduction to Statistics and Data Analysis, Christian Heumann and Michael Schomaker Shalabh, Springer

Ressources en bibliothèque

- Introduction to Statistics and Data Analysis / Heumann