

MSE-213

Probability and statistics for materials science

Moll Philip

| Cursus | Sem. | Type |
|-----------------------------------|------|------|
| Materials Science and Engineering | BA4 | Obl. |

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|----------------------------|-----------------|
| 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](#)