GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Experimental Design (I001280)

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0 **Study time 75 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	English	Gent	lecture seminar
B (semester 2)	English	Gent	lecture seminar independent work

Lecturers in academic year 2024-2025

Meys, Joris	LA26	staff member
Luca, Stijn	LA26	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Master of Science in Bioinformatics(main subject Systems Biology)	3	A
Master of Science in Bioscience Engineering: Agricultural Sciences	3	A
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology	3	A
Master of Science in Bioscience Engineering: Environmental Technology	3	A
Master of Science in Bioscience Engineering: Food Science and Nutrition	3	A
Master of Science in Chemical Engineering	3	A
Master of Science in Chemical Engineering	3	A
Master of Science in Statistical Data Analysis	5	B
Exchange Programme in Bioscience Engineering: Agricultural Sciences (master's level)	3	A
Exchange Programme in Bioscience Engineering: Cell and Gene Biotechnology (master's level)	3	A
Exchange Programme in Bioscience Engineering: Chemistry and Bioprocess Technology (master's level)	3	A
Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)	3	A
Exchange Programme in Bioscience Engineering: Food Science and Nutrition (master's level)	3	A

Teaching languages

English

Keywords

Statistics, experimental design, sampling, sample size calculation, optimal experimental design, factorial designs, response surface design, split-plot design.

Position of the course

The course content is closely related to the theory and practice of linear statistical models (e.g. regression analysis and analysis of variance) as taught in 'Statistical Data Processing'. Although the design phase of a study appears prior to the experimentation and statistical analysis phases, a design cannot be constructed without knowing how the data, that will arise from the designed study, will be analysed. A very good knowledge of the theory of linear statistical models is therefore very important.

The importance of experimental design for scientific and operational research is evident. A good design is necessary to make the statistical analysis of the data resulting from the

experiment correctly interpretable. Moreover, efficiency in terms of cost versus precision may be considerably increased by choosing an appropriate design. The aim of this course in not only to teach students to design studies, but also more generally to broaden their understanding of the relation between experimenting and induction.

Contents

Offering session A:

- **General concepts:** sampling from a population, randomization, random sampling, stratified sampling, bias, confounding.
- **Sample size calculation:** exact methods, approximation methods using simulation, asymptotic approximation, adaptive designs and interim analysis.
- **Optimal experimental design:** methods based on the Fisher information matrix (e.g. A, D and E optimality), orthogonality of a design, designs for parameter estimation versus prediction, Fedorov algorithm, FDS-plots.
- **Factorial designs (designs for ANOVA):** screening designs, full and fractional factorial designs (aliasing and confounding), resolution of a design, replication, orthogonal designs.

Offering session B also includes:

- **Extended topics:** blocking in factorial designs, response surface design, split-plot designs
- The content of **a scientific paper** related to the topics of the course.

Initial competences

Experimental Design builds on certain learning outcomes of the course unit Statistical Data Processing; or the learning outcomes have been achieved differently.

Final competences

1 Translate the study objectives into an appropriate design. Analyze the design correctly.
2 Assess the relation between the design and the statistical analysis method
3 Assess the properties of a design, its merits and its shortcommings
4 Assess the relation between the theory and the applications of “experimental design”
5 Analyze the design correctly.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture, Independent work

Study material

Type: Syllabus

Name: Experimental Design
Indicative price: € 15
Optional: no
Language : English
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : Yes

References

Montgomery, D., C. (2020). Design and Analysis of Experiments (10th ed.). John Wiley & Sons.
Goos, P. and Jones, B. (2011). Optimal design of experiments: a case study approach. John Wiley & Sons.
Cox, D. and Read, N. (2000). The theory of the design of experiments. Chapmann and Hall.

Course content-related study coaching

In the practical sessions in the PC classes the students are coached by an assistent. Students can make an appointment to ask questions to the lecturer. Questions and answers can be exchanged in Ufora.

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment open-book

Examination methods in case of periodic assessment during the second examination period

Written assessment open-book

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

The periodical evaluation consists in a written open book examination with the use of R. As well insight in the theory as the application of the methods on practical problem settings will be evaluated.

Calculation of the examination mark

Final exam only (100%)