

Experimental Design (I001280)

Wegens Covid19 kan mogelijk afgeweken worden van de onderwijs- en evaluatievormen. Dergelijke afwijkingen zullen via Ufora worden gecommuniceerd.

Cursusomvang *(nominale waarden; effectieve waarden kunnen verschillen per opleiding)*

Studiepunten 3.0 **Studietijd** 75 u **Contacturen** 30.0 u

Aanbodsessies en werkvormen in academiejaar 2021-2022

A (semester 2)	Engels	Gent	hoorcollege	15.0 u
			werkcollege: PC- klasoefeningen	15.0 u

Lesgevers in academiejaar 2021-2022

Luca, Stijn	LA26	Verantwoordelijk lesgever
Stock, Michiel	LA26	Medelesgever

Aangeboden in onderstaande opleidingen in 2021-2022

	stptn	aanbodssessie
Master of Science in Chemical Engineering	3	A
Master of Science in Sustainable Materials Engineering	3	A
Master of Science in de ingenieurswetenschappen: chemische technologie	3	A
Master of Science in de bio-ingenieurswetenschappen: bos- en natuurbeheer	3	A
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology	3	A
Master of Science in de bio-ingenieurswetenschappen: landbouwkunde	3	A
Master of Science in de bio-ingenieurswetenschappen: levensmiddelenwetenschappen en voeding	3	A
Master of Science in de bio-ingenieurswetenschappen: milieutechnologie	3	A
Uitwisselingsprogramma bio-ingenieurswetenschappen: landbouwkunde (niveau master-na-bachelor)	3	A
Uitwisselingsprogramma bio-ingenieurswetenschappen: cel- en genbiotechnologie (niveau master-na-bachelor)	3	A
Uitwisselingsprogramma bio-ingenieurswetenschappen: chemie en bioprocestechnologie (niveau master-na-bachelor)	3	A
Uitwisselingsprogramma bio-ingenieurswetenschappen: milieutechnologie (niveau master-na-bachelor)	3	A
Uitwisselingsprogramma bio-ingenieurswetenschappen: Food Science and Nutrition (niveau master-na-bachelor)	3	A

Onderwijstalen

Engels

Trefwoorden

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

Situering

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 is not only to teach students to design studies, but also more generally to broaden their understanding of the relation between experimenting and induction.

Inhoud

- **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, blocking, replication, orthogonal designs.
- **Designs for regression:** response surface methodology, central composite designs, alpha for rotatability or orthogonality.
- **Split-plot design.**

Begincompetenties

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

Eindcompetenties

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

Creditcontractvoorwaarde

Toelating tot dit opleidingsonderdeel via creditcontract is mogelijk mits gunstige beoordeling van de competenties

Examencontractvoorwaarde

Dit opleidingsonderdeel kan niet via examencontract gevolgd worden

Didactische werkvormen

Hoorcollege, werkcollege: PC-klasoefeningen

Leermateriaal

A syllabus is available at ca. € 10. All learning materials are made available through Minerva.

Referenties

- 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. Chapman and Hall.
- Weber, D. and Skillings, J. (2000). A first course in the design of experiments. CRC Press.
- Cobb, G. (1998). Introduction to design and analysis of experiments. Springer-Verlag.

Vakinhoudelijke studiebegeleiding

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

Evaluatiemomenten

periodegebonden en niet-periodegebonden evaluatie

Evaluatievormen bij periodegebonden evaluatie in de eerste examenperiode

Schriftelijk examen met open vragen

Evaluatievormen bij periodegebonden evaluatie in de tweede examenperiode

Schriftelijk examen met open vragen

Evaluatievormen bij niet-periodegebonden evaluatie

Werkstuk

Tweede examenkans in geval van niet-periodegebonden evaluatie

Examen in de tweede examenperiode is mogelijk

Toelichtingen bij de evaluatievormen

The final examination consists of a written examination with open questions. Most of the questions aim to assess the insight of the student in the design of experiments. This happens at the borderline between theory and application (partly open book and closed book exam).

The project work relates to a real life problem. Students may work together in groups of 3 to 4 persons. The result of the project work is a written report that should satisfy conventional scientific and professional standards.

Eindscoreberekening

The final mark is a weighted average of:

- final examination (14/20)
- project (6/20)