

## Applied Statistics (I002756)

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

**Credits 5.0**

**Study time 150 h**

**Course offerings and teaching methods in academic year 2024-2025**

A (semester 1)

English

Gent

lecture

seminar

**Lecturers in academic year 2024-2025**

Meys, Joris

LA26

staff member

Coussement, Louis

LA26

lecturer-in-charge

Daly, Aisling

LA26

co-lecturer

**Offered in the following programmes in 2024-2025**

Master of Science in Sustainable Land Management(main subject Land and Groundwater Management)

**crdts**

5

**offering**

A

International Master of Science in Soils and Global Change (main subject Physical Land Resources and Global Change)

5

A

International Master of Science in Soils and Global Change (main subject Soil Biogeochemistry and Global Change)

5

A

International Master of Science in Soils and Global Change (main subject Soil Ecosystem Services and Global Change)

5

A

International Master of Science in Soils and Global Change (main subject Soil-Plant System Processes and Global Change)

5

A

Master of Science in Sustainable Land Management(main subject Urban Land Engineering )

5

A

International Master of Science in Health Management in Aquaculture

5

A

International Master of Science in Rural Development

5

A

Master of Science in Aquaculture

5

A

Master of Science in Food Technology

5

A

Master of Science in Nutrition and Food Systems

5

A

Exchange Programme in Bioscience Engineering: Agricultural Sciences (master's level)

5

A

Exchange Programme in Bioscience Engineering: Food Science and Nutrition (master's level)

5

A

**Teaching languages**

English

**Keywords**

Statistics, Statistical inference, Data analysis, Regression analysis

**Position of the course**

This course is tailored for researchers who aim to analyze (biological) data and derive statistically sound conclusions to address their research inquiries. The primary focus is on the accurate application of prevalent statistical methodologies, coupled with the critical interpretation and effective reporting of findings. A comprehensive understanding of the mathematical underpinnings behind these techniques is essential for students to navigate through the course material effectively. The emphasis of this course lies on application of statistical methods, hence an important part of the study time is attributed to performing analysis on an independent base using the statistical software program R.

**Contents**

The content of this course includes basic and prevalent statistical methods used for

data analysis and is divided into several parts:

- Basics of statistical inference: populations, sampling, distributions, estimating parameters and confidence intervals.
- Hypotheses and statistical tests for a set of estimates including proportions, means, and frequencies: e.g. Student's T-test, Chi-square test etc.
- The framework of the (linear) regression analysis: relations between variables, testing model parameters, variance analysis, model selection.
- Modelling using linear regression models: additive models, interaction models, ANOVA models, post hoc testing.

### **Initial competences**

We expect students to have:

- A basic knowledge of calculus and probability theory (random variables, basic probability calculations, common distributions).
- A knowledge of basic data science (variable types, common measures of center and spread of a sample distribution).
- Digital literacy: knowledge of computer basics (folder structures, file types, installing and executing software) coupled with a basic proficiency in performing tasks on any operating system.
- A basic knowledge of scientific computing using any language/software package. Knowledge of R specifically is useful but certainly not required.

### **Final competences**

- 1 The student understands the basics of statistical data exploration and statistical inference.
- 2 The student can perform a complete analysis in R, starting from a dataset and a research question.
- 3 The student recognizes important problems/limitations in study design and analysis methods and understands how these may affect conclusions based on their results.
- 4 The student can report the results of a statistical data analysis correctly, concisely and clearly.

### **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

### **Extra information on the teaching methods**

Theory : lectures.

Exercises : seminars with guided exercises on PC.

Progress can be self-evaluated by the students using mandatory online self-tests.

### **Study material**

None

### **References**

J. Neter, M. Kutner, C. Nachstheim, W. Wasserman. 'Applied Linear Statistical Models', 5th edition. McGraw-Hill Education, 2005

### **Course content-related study coaching**

During the exercise sessions the students are coached by assistants. Through the electronic learning environment students can exchange questions and answers outside lecture hours among themselves and with lecturers. Individual questions may be answered during a meeting with the lecturer after making an appointment.

### **Assessment moments**

end-of-term and continuous assessment

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

Skills test, Written assessment with open-ended questions

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

Written assessment with open-ended questions

### **Examination methods in case of permanent assessment**

Skills test, Written assessment with open-ended questions

### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible in modified form

### **Extra information on the examination methods**

#### **Examination methods in case of non-periodic assessment:**

The default examination method is non-periodic/continuous assessment (see 'Extra information NPE' below), in the form of online tests with multiple choice and open ended questions; written assignments with open ended questions.

#### **Examination methods in case of periodic assessment**

If students do not pass the first examination (NPE during the semester), then they will take the second chance examination, in the form of a written exam (see 'Evaluation for periodic evaluation (PE; second exam chance).

#### **Extra information for non-periodic evaluation (NPE)**

Students are evaluated throughout the semester upon completion of a substantial and comprehensive part of the course (divided into 3 parts). This is supplemented with two self-tests for which students get unlimited tries (best score counts):

- NPE1: self-tests, dates to be announced via Ufora – online test;
- NPE2: Chapter 1 and 2, week 5 – online test;
- NPE3: Chapter 3, week 8 – written test;
- NPE4: Chapter 4, week 12 – written test.

All parts of non-periodic evaluation assess both theoretical concepts and application of data analytical and statistical methods (by use and interpretation of R statistical software). This assessment format is intended to keep students active in keeping up with the course material over the semester.

Remark: If students are not able to participate in the NPE, e.g. due to international mobility or other exceptional circumstances (i.e. after failing two exam chances in the previous academic year), they will be offered two exam chances of the periodic evaluation format (one in the first exam period and one in the second exam period).

#### **Evaluation for periodic evaluation (PE; second exam chance)**

Students are evaluated through a written exam assessing both theoretical concepts and application of data analytical and statistical methods (by use and interpretation of R statistical software).

Remark: For students that are abroad during the second semester due to international mobility, the second exam chance will be provided during the first exam period (i.e. early January). This exam chance will also be opened to students unable to follow the NPE due to international mobility (see evaluation for NPE).

### **Calculation of the examination mark**

#### **Non-periodic evaluation (NPE):**

All parts of NPE are weighted by their importance and respective proportion of the course: NPE1 (2 x 1pt) + NPE2 (5 pts) + NPE3 (5 pts) + NPE4 (8 pts) resulting in a final score on a total of 20 points.

#### **Periodic evaluation (PE):**

PE is scored entirely based on the written exam, resulting in a final score on a total of 20 points.

### **Facilities for Working Students**

Upon agreement by the teaching team, work students that are not able to participate in the NPE can be offered two exam chances of the periodic evaluation format (see Details of evaluation section).