

## Statistics and Data Processing (C001195)

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

**Credits 6.0**

**Study time 180 h**

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

A (semester 1)

Dutch

Gent

lecture

seminar

**Lecturers in academic year 2024-2025**

van der Wel, Arjen

WE05

lecturer-in-charge

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

[Bachelor of Science in Physics and Astronomy](#)

**crdts**

6

**offering**

A

**Teaching languages**

Dutch

**Keywords**

Statistics, data treatment

**Position of the course**

This course unit belongs to the learning pathway "Experimental physics and astronomy; data processing" in the Bachelor program Physics and Astronomy. An introduction in statistics is given. In particular the techniques that are often used in physics and astronomy are introduced and trained. The student learns how to apply statistical methods in writing reports or in the interpretation of experimental results. This is an essential prerequisite for projects or laboratory courses.

**Contents**

- Distributions: mean value, spreads, correlations.
- Theoretical distributions: binomial distribution, Poisson distribution, Gauss distribution, multidimensional Gauss.
- Errors: central limit theorem, combining errors, systematic errors.
- Estimating: properties, minimum variance bound, maximum likelihood, extended maximum likelihood, moments, stratified sampling.
- Least squares: method, fitting a straight line, binned data,  $\chi^2$ -distribution.
- Probability and confidence: Bayes' theorem, confidence levels, confidence regions.
- Taking decisions: testing hypotheses, nul-hypothesis, goodness-of-fit, comparing two samples, Student-t distribution.
- Monte Carlo: pseudo-random generators, numerical integrals, generating distributions, simulations, algorithms.
- Queuing theory: ticket sales, queue with random structure.
- Markov chains: random walk, gambler's ruin.

**Initial competences**

No particular prerequisites necessary. A basic knowledge of combinatorics, analysis and algebra is assumed.

**Final competences**

- 1 Have the ability to write scientific reports with a good understanding of the reached accuracy.
- 2 Have a basic knowledge of computer intensive simulation techniques.
- 3 Be able to compare two experimental results or experiment and theory.

**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

**Study material**

Type: Syllabus

Name: Syllabus

Indicative price: Free or paid by faculty

Optional: no

Additional information: available through Ufora

Type: Slides

Name: Lectures slides

Indicative price: Free or paid by faculty

Optional: no

Additional information: available through Ufora

**References**

B.Roe, "Probability and statistics in experimental physics" (Springer, 2001)

R.J.Barlow, "Statistics: a guide to the use of statistical methods in the physical sciences" (John Wiley & Sons, 1993)

**Course content-related study coaching**

After the lectures the lecturer is available for additional explanations. The lecturer is always reachable through e-mail.

**Assessment moments**

end-of-term assessment

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

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

not applicable

**Extra information on the examination methods**

Theory: written (closed book)

Exercises: written (open book)

**Calculation of the examination mark**

Theory: 40%

Exercises: 60%