Faculty of Science

MASB13, Mathematical Statistics for Physicists, 7.5 credits

Matematisk statistik för fysiker, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2022-04-22 to be valid from 2022-04-22, spring semester 2023.

General Information

The course is an elective course for first-cycle studies for a Bachelor of Science in physics.

Language of instruction: Swedish

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The course is intended to give the student the basics in mathematical modelling of random variation and an understanding of the principles behind statistical analysis. It shall also give the students a toolbox containing the most commonly used models and methods, as well as the ability to use these in practical situations.

The course fills two purposes, providing a fundamental knowledge of mathematical statistics, as well as giving a foundation for further studies.

The fundamental knowledge is essential for those who, in their professional lives, will not necessarily be involved in statistical analyses on a daily basis, but who, on occasion, will be expected to perform basic statistical tests and present the results to their colleagues. They will also be expected to be able to read and assess the analyses of others.

The course shall also give a basis for further studies, both in probability theory and inference theory, as well as in the application areas.

Knowledge and understanding
For a passing grade the student must be able to:

- explain the concepts of independence, probability, distribution, expectation, and variance,
- calculate the probability of an event, and the expectation and variance from a given distribution,
- describe fundamental techniques for statistical inference and be able to use them on basic statistical models,
- describe the similarities and differences concerning statistical relationship between two variables and a cause-effect relationship between two variables.

Competence and skills
For a passing grade the student must be able to:

- construct a simple statistical model describing a problem based on a real life situation or on a collected data material,
- use a computational program for simulation and interpretation of statistical models, as well as for data analysis,
- choose, modify, perform, and interpret a statistical procedure that answers a given statistical problem,
- use statistical terms within the field in writing.

Judgement and approach
For a passing grade the student must be able to:

- relate questions regarding random variation and observed data, as they appear in applications, to the concepts of random variables, distributions, and relationships between variables,
- examine a statistical model and its ability to describe reality,
- examine a simple measurement situation and judge whether data is collected in a way that allows further analysis.

Course content

The course treats:

- Bayes theorem.
- Expectation and variance.
- Normal distribution
- binomial distribution, and other important distributions for measurements and frequencies.
- Data analysis.

Statistical inference:

- Point estimates.
- Interval estimates and hypothesis testing.
- Methods for normally distributed observations.
- Approximative methods based on the normal distribution.
- Comparisons between expectations.
- Variability, and distributions.
- Estimates of proportions.
- Regression analysis and calibration.

- Covariance och correlation.
- Correlation between two explanatory variables.

Examples are chosen with respect to the different programs.

Course design

Teaching consists of lectures, exercises, projects and computer exercises. Participation in computer exercises and project is compulsory.

Assessment

Examination consists of a written exam at the end of the course, and computer exercises, project report as wells as a computational ability test during the course. Students who did not pass the ordinary exam are offered a re-examination shortly after.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
For a passing grade on the entire course a passed written exam, passed project reports as well as participation in all compulsory course parts are required.

The grades awarded for the computer exercises, project reports and computer based test are Fail and Pass. The grade on the written exam is
Fail, Pass, Pass with distinction. The final grade is the grade on the written exam.

Entry requirements

For admission to the course, general entry requirements and 67.5 credits of studies in science including knowledge equivalent to the courses:

MATA21 Analysis in One Variable, 15 credits
MATA22 Linear Algebra 1, 7.5 credits
NUMA01 Computational Programming with Pyhon, 7.5 credits
MATB21 Analysis in Several Variables, 1 7.5 credits

and 30 credits in physics.

Further information

The course replaces the course MASB03 Mathematical Statistics for Physicists may not be included in a higher education qualification with MASB03 or together with any

course with course code starting with MASB neither can MASA02 Mathematical Statistics, basic course, 15 credits be included.

Subcourses in MASB13, Mathematical Statistics for Physicists

Applies from V23

2301 Computational Ability Test, 0,5 hp
Grading scale: Fail, Pass
2302 Laboratory Work, 1,5 hp
Grading scale: Fail, Pass
2303 Examination, 5,5 hp
Grading scale: Fail, Pass, Pass with distinction