

**COURSE DATA****Data Subject**

Code	33101
Name	Mathematics II
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Faculty of Biological Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	163 - Mathematics II	Basic Training

Coordination

Name	Department
PARREÑO TORRES, CONSUELO	130 - Statistics and Operational Research

SUMMARY

The subject Mathematics II is conceived as a fundamental course for the education of any experimental scientist. Its aim is to equip students with the necessary tools and basic concepts of Statistics to formulate statistical hypotheses, recognize simple probabilistic models, statistically analyze data obtained directly from nature or as a result of laboratory experiments, and make informed decisions based on the conclusions drawn from such analysis. Students will develop skills in collecting, organizing, analyzing, and interpreting environmental data using computer tools and statistical software, with the ultimate goal of effectively applying statistical principles in the study and comprehension of environmental phenomena.

PREVIOUS KNOWLEDGE



Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Relationship with other subjects in the same degree program No registration restrictions have been specified with other subjects in the curriculum.

Prerequisites or recommendations:

- Ability to interpret practical statements using mathematical language.
- Competence in the use of technological tools and mathematical software.
- Knowledge of the basic concepts of Probability corresponding to Mathematics I in the first year of high school.

OUTCOMES

1104 - Degree in Environmental Sciences

- Capacidad de planificar experimentos sencillos útiles para alcanzar objetivos del estudio.
- Capacidad de describir y analizar el conjunto de datos obtenidos en el experimento utilizando software adecuado.
- Saber interpretar los resultados proporcionados por el software utilizado.
- Saber elaborar y presentar un informe del estudio realizado.

LEARNING OUTCOMES

1. Design simple experiments that are useful for achieving the aforementioned objectives.
2. Appropriately describe and summarize the observed dataset in the experiment.
3. Utilize statistical software for data analysis and visualization.
4. Accurately interpret the results provided by the software used.
5. Prepare and present a report on the conducted study.

DESCRIPTION OF CONTENTS

1. Exploratory Data Analysis

- 1.1. Populations and samples.
- 1.2. Types of variables and their relationships.
- 1.3. Graphical description of variables and analysis of their relationships.
- 1.4. Numerical descriptive statistics.



2. Probability

- 2.1. Probability of events.
- 2.2. Probability: Discrete distributions.
- 2.3. Probability: Continuous distributions.

3. Inference in a Population

- 3.1. Population parameters.
- 3.2. Estimation of the population mean.
- 3.3. Hypothesis testing for the mean.
- 3.4. Assumptions for the validity of the t-Student test.
- 3.5. Non-parametric alternative: Wilcoxon test.

4. Analysis of Two Samples

- 4.1. Related samples.
 - 4.1.1. Experimental design with related observations.
 - 4.1.2. - t-test and confidence interval.
 - 4.1.3. - Wilcoxon signed-rank test.
- 4.2. - Independent samples.
 - 4.2.1. - Design of experiments with independent observations.
 - 4.2.2. - t-test and confidence interval.
 - 4.2.3. - Mann-Whitney U test.

5. Analysis of two or more independent samples.

- 5.1. - Design of experiments with k independent samples.
- 5.2. - Analysis of variance and post hoc comparisons.
- 5.3. - Kruskal-Wallis test.

6. Analysis of categorical data

- 6.1. - Analysis of proportions.
- 6.2. - Goodness-of-fit test.
- 6.3. - Analysis of contingency tables.

7. Linear regression

- 7.1. - Parametric interpretation of regression: the linear model.
- 7.2. - Statistical inference about the slope.
- 7.3. - Coefficient of correlation.



WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Computer classroom practice	27,00	100
Study and independent work	50,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

In theory classes, real-world problems will be presented, which require the corresponding methodology for each topic. Subsequently, the appropriate statistical techniques will be introduced and applied to problem-solving using statistical software. Students will be provided with a collection of problems to work on independently to enhance their understanding of the subject.

The practical sessions, held in the computer lab and synchronized with the theory, will provide students with the opportunity to apply these techniques to problem-solving. They will be required to solve assigned problems and submit them for evaluation. Each student will receive a dossier containing the practice content and the problems to be solved.

EVALUATION

Given that the objectives of the Mathematics II subject revolve around the application of statistical techniques to real-world problems, the acquired knowledge will be jointly evaluated in both theory and computer lab sessions. This evaluation will occur in two stages:

1. Continuous evaluation:

- Attendance control in practical classes (up to 0.5 points, i.e., 5% of the final grade).
- Performance in practical sessions (up to 0.5 points, i.e., 5% of the final grade).
- Completion of one or two assessments based on the practical classes (up to 1 point, i.e., 10% of the final grade).

2. Final evaluation, consisting of a theoretical-practical exam that will require a solid understanding of theoretical concepts and the ability to interpret different results presented in the standard format of the statistical software used during the course (up to 8 points, i.e., 80% of the final grade).

NOTES:



- Grades obtained in stage 1 will be retained for both exam periods within the academic year in which they were completed, as the evaluation can only take place during the second semester and not during the extraordinary exam period. The continuous evaluation grade does not carry over to the next academic year.
- To pass the subject, a final grade of 5 or higher must be obtained. The final grade will be determined by the combined score of the final exam and the continuous evaluation

REFERENCES

Basic

- P.M. Berthouex and L.C. Brown. Environmental Engineers. Lewis Publishers, second edition, 2002.
- J. Verzani. Using R for Introductory Statistics. Chapman & Hall / CRC, 2005.
- M.L. Samuels and J.A. Witmer. Statistics for the Life Sciences. Pearson Education, 2003
- W. Chase and F. Bown. General Statistics. Wiley and Sons, 1992

Additional

- P. Dalgaard. Introductory Statistics with R. Springer, 2002.
- Walter W. Piegorsch and A. John Bailer. Analyzing Environmental Data. Wiley, 2005
- Clemens Reimann, Peter Filzmoser, Robert Garret, and Rudolf Dutter. Statistical Data Analysis Explained. Applied Environmental Statistics with R. Wiley, Chichester, UK, 2008