COURSE DATA

Data Subject	
Code	33123
Name	Mathematics II
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	3 - Matemáticas	Basic Training

Coordination

Name	Department
MARTINEZ BLAZQUEZ, MARIA DEL CARMEN	130 - Statistics and Operational Research

SUMMARY

Mathematics II is a basic subject in scientific education. It aims to provide students with the basic concepts and analytical tools required to recognize simple probabilistic models, formulate hypothesis tests, analyze observational or experimental data and make decisions based on the conclusions drawn from these analysis.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

It is assumed that students will have achieved an appropriate level of mathematics and probability at high school or equivalent. It is recommended that students be able to formulate mathematical problems that arise from everyday situations and use problem solving to investigate and understand mathematical content.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1101 - Degree in Biochemistry and Biomedical Sciences

- Capacidad de pensamiento lógico-matemático.
- Utilización del lenguaje matemático y estadístico.
- Aplicar conceptos matemáticos a casos prácticos de índole biológica.
- Saber seleccionar tamaños de muestra óptimos para los objetivos de un estudio.
- Saber obtener muestras aleatorias.
- Analizar los datos observados utilizando software estadístico adecuado.
- Comprender los conceptos de estimaciones puntuales y por intervalos y saber calcularlas.
- Comprender los conceptos de contraste de hipótesis, estadístico de contraste y p-valor y saber calcularlos.
- Entender y plantear los problemas de estadística que se presentan en biología.
- Saber utilizar herramientas informáticas para analizar los problemas estadísticos.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

• To plan simple experiments to achieve the objectives of the study.

• To describe and synthesize the data set observed in the experiment.

• To analyze the observed data using appropriate statistical software.

• To interpret the results provided by the statistical software.

• To write and present a report of the study

DESCRIPTION OF CONTENTS

1. Exploratory Data Analysis

1.1.- Populations and samples.
1.2.- Types of variables and relationships between them.
1.3.- Graphical description of variables and analysis of their relationship.
1.4.- Description of samples.
1.5.- Description of populations through probabilistic models.

2. Inferences about a population

2.1.- Parameters of a population.
2.2.- Estimating the population mean.
2.3.- Hypothesis testing of a single population mean.

3. Two Sample Analysis

3.1.- Paired samples.
3.1.1.- Paired Experimental Design.
3.1.2.- T-Test and Confidence Interval.
3.1.3.- Paired Sample Sign Test.
3.2.- Independent Samples.
3.2.1.- Independent Samples Design.
3.2.2.- T-Test and Confidence Interval.
3.2.3.- Mann-Whitney Test.

4. K Independent Samples Analysis

4.1.- K Independent Samples Design.
4.2.- Analysis of Variance and Post hoc Comparisons.
4.3.- Kruskal-Wallis Test.

5. Categorical Data Analysis

5.1.- Proportion Analysis.
5.2.- Goodness of fit Analysis.
5.3.- Contingency Tables Analysis.

6. Linear Regression

6.1.- Parametric Regression Analysis: The Linear Model.
6.2.- Statistical Inference about the slope.
6.3.- Correlation Coefficients.
6.4.- Multiple Regression.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	31,00	100
Computer classroom practice	26,00	100
Tutorials	3,00	100
Development of group work	10,00	0
Development of individual work	10,00	0
Study and independent work	30,00	0
Preparation of evaluation activities	15,00	0
Preparing lectures	13,00	0
Preparation of practical classes and problem	12,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Statistical concepts and methods will be introduced during lecture sessions, always through real studies and by using real data in at least some of these. The appropriate statistical technique to solve the real problem will be applied by using statistical software. Independent study will include to work through the problems, from problem formulation, through solution of the formulated problem, to interpretation and presentation of the solution.

Practical sessions, in computer lab, will be synchronized with the lectures; in these classes the students will solve problems by applying the statistical methods introduced in the lectures through a statistical package. A dossier describing the contents of the practical sessions, including the problems to be solved during the class, will be accessible in the web platform; some of these problems will be delivered to the teacher for evaluation.

Tutorials in reduced groups will serve to remember, discuss and focus the concepts that the student must know and understand at the time. They will be based on additional material, provided to students in advance.

All documents will be available on the Virtual Classroom environment PDF (portable document format).

EVALUATION

Since the objectives of the course Mathematics II focus on applying statistical techniques to real problems, theoretical knowledge and practical skills will be jointly evaluated. Evaluation will be made in two stages:

1. Continuous evaluation corresponding to:
    - active participation in tutorials and seminars (up to 0.5 points, 5% of final grade) and
    - problems delivered in practical sessions (up 1.8 points, 18% of final grade)
2. Final exam, involving theoretical concepts and practical skills, consisting of solving problems similar to those from the practical sessions and the proposed list for independent work. Solving these problems will require interpreting the results provided by the statistical software used during the course (up to 8 points, ie 80% of final grade

NOTES:

- In the continuous evaluation, a zero mark will be assigned to any required and undelivered tasks.
- Grade earned in continuous evaluation (**paragraph 1**) will be the same in the two examination periods of the academic year.
- To pass the subject it will be necessary to get a final grade (Continuous evaluation + Final Exam) equal or greater than 5.

REFERENCES

Basic

- Milton, J. S. (2007). Estadística para Biología y Ciencias de la Salud. Madrid: Ed. Interamericana - McGraw-Hill. 3ª Edición. (Versión en papel y eBook)
-Rosner, B. (2016). Fundamentals of Biostatistics. Boston, MA. Cengage Learning. 8ª Edición. (Versión en papel y en eBook)
-Samuels, M. L., Witmer, J. A. & Schaffner, A. (2012). Fundamentos de Estadística para las Ciencias de la Vida. Madrid. Pearson Educación. 4ª Edición. (Papel)
-Samuels, M. L., Witmer, J. A. & Schaffner, A. (2012). Fundamentos de Estadística para las Ciencias de la Vida. México D.F. Pearson Educación. 4ª Edición. (eBook)
-Samuels, M. L., Witmer, J. A. & Schaffner, A. (2016). Statistics for the Life Sciences. 5ª Edición. Pearson. (Versión en papel y en eBook)

Additional

- Armitage, P. & Berry, G. (1997). Estadística para la Investigación Biomédica. Madrid: Harcourt Brace. 3ª Edición.
-Armitage, P., Berry, G. & Matthews, J. N. S. (2002). Statistical Methods in Medical Research. 4 th ed. Blackwell, Oxford.
-Bowers, D. (2014). Medical Statistics from Scratch. An Introduction for Health Professional. John Wiley & Sons Ltd. 3ª Edición.
-Quinn, G. P. y Keough, M. J. (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press.
-Sokal, R. R. y Rohlf, F. J. (2003). Introducción a la Bioestadística. Ed. Reverté