

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

|                      |                |
|----------------------|----------------|
| <b>Code</b>          | 33123          |
| <b>Name</b>          | Mathematics II |
| <b>Cycle</b>         | Grade          |
| <b>ECTS Credits</b>  | 6.0            |
| <b>Academic year</b> | 2020 - 2021    |

**Study (s)**

| <b>Degree</b>                                         | <b>Center</b>                  | <b>Acad. year</b> | <b>Period</b> |
|-------------------------------------------------------|--------------------------------|-------------------|---------------|
| 1109 - Degree in Biochemistry and Biomedical Sciences | Faculty of Biological Sciences | 1                 | Second term   |

**Subject-matter**

| <b>Degree</b>                                         | <b>Subject-matter</b> | <b>Character</b> |
|-------------------------------------------------------|-----------------------|------------------|
| 1109 - Degree in Biochemistry and Biomedical Sciences | 3 - Matemáticas       | Basic Training   |

**Coordination**

| <b>Name</b>                         | <b>Department</b>                         |
|-------------------------------------|-------------------------------------------|
| 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.

## OUTCOMES

### 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

- 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                |
| <b>TOTAL</b>                                 | <b>150,00</b> |                  |

## 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. (2001). Estadística para Biología y Ciencias de la Salud. Madrid: Ed. Interamericana - McGraw-Hill. 3ª Edición.
- Rosner, B. (2016). Fundamentals of Biostatistics. Cengage Learning. Boston. 8ª Edición (e-book).
- Samuels, M. L., Witmer, J. A. & Schaffner, A. (2012) Fundamentos de Estadística para las Ciencias de la Vida. Pearson Educación, Madrid. 4ª Edición (e-book)

### Additional

- Armitage, P. & Berry, G. (1997). Estadística para la Investigación Biomédica. Madrid: Harcourt Brace. 3ª Edición.
- Azzimonti Renzo, J.C. (2003). Bioestadística aplicada a Bioquímica y Farmacia. Ed. Universitaria de la UNAM, 2ª Edición.
- Bowers, D. (2008). Medical Statistics from Scratch. An Introduction for Health Professional. John Wiley & Sons Ltd. 2ª 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.



## ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

### **1 y 2) Contenidos y Volumen de trabajo.**

Sin cambios

### **3) Metodología.**

Tanto la docencia teórica como práctica se ajustará a los horarios aprobados por la CAT pero siguiendo un modelo de Presencialidad / No presencialidad en la medida en que las circunstancias sanitarias y la normativa lo permitan y teniendo en cuenta el aforo de las aulas de teoría y prácticas. Se procurará la máxima presencialidad posible y la modalidad no presencial de las clases teóricas y/o prácticas se podrá realizar mediante videoconferencia cuando el número de estudiantes supere el coeficiente de ocupación requerido por las medidas sanitarias.

### **4) Evaluación.**

El peso de la evaluación continua y del examen se mantiene. Sin embargo, ante la posibilidad de que algunos estudiantes no puedan asistir a las sesiones de seminarios, tutorías y/o prácticas, la evaluación continua se realizará mediante corrección de tareas que los estudiantes entregarán vía Aula Virtual.

En caso de que los exámenes no pudieran ser presenciales, se realizarían 'on line' en Aula Virtual mediante las herramientas disponibles.

Los detalles concretos de la adaptación a las situaciones que se pudieran producir se supervisarán por la CAT y se comunicarán a los estudiantes a través de Aula Virtual.