COURSE DATA

Data Subject	
Code	33040
Name	Mathematics II
Cycle	Grade
ECTS Credits	6.0
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Faculty of Biological Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1100 - Degree in Biology	1 - Mathematics	Basic Training

Coordination

Name	Department
RABENA PEREZ, MARIA TERESA	130 - Statistics and Operational Research
SENDRA PINA, MARIO	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. The concepts of differentiation and integration, introduced in the previous course Mathematics I, help the student to understand those of probability density and distribution function, which are the basis for any statistical method. On the other side, Mathematics II introduces the concepts of Binomial Distribution and Chi-Square Test, which are basic for posterior subjects, such as “Genetics” or “Evolutionary Processes and Mechanisms”. Moreover, understanding and management of all the statistical techniques introduced in Mathematics II will be necessary for the compulsory subject “Integrated Experimentation in Biology”.

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

1100 - Degree in Biology

- Capacidad de pensamiento lógico-matemático.
- Utilización del lenguaje matemático y estadístico.
- Saber representar gráficamente funciones matemáticas básicas.
- Comprender el concepto de integral de una función y su relación con el área comprendida bajo la misma.
- Saber seleccionar tamaños de muestra óptimos para los objetivos de un estudio.
- Conocer software estadístico adecuado para análisis de diferentes tipos de datos.
- 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.
- Saber utilizar herramientas informáticas para analizar los problemas estadísticos.
- Saber obtener muestras aleatorias.
- Entender y plantear los problemas de estadística que se presentan en la Biología.

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	5,00	0
Study and independent work	14,00	0
Preparing lectures	35,00	0
Preparation of practical classes and problem	26,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Statistical concepts and methods will be introduced during lecture sessions, always through biological 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

Learning, knowledge and skills achieved by students will be continuously evaluated throughout the course, according to the following guidelines:

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

i. Continuous evaluation corresponding to tasks delivered in tutorials, lectures or practical sessions (up 2 points, 20% of final grade)

ii. 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 7 points, ie 70% of final grade

2. Interdisciplinary seminar (up 1 point, ie 10% of final grade) will serve to evaluate the social skills: teamwork, use of English and disseminating scientific knowledge. Alternatively, students can make another activity, supported by the CAT as part of an Education Innovation Project.

NOTES:

- In the continuous evaluation, a zero mark will be assigned to any required and undelivered tasks.

- Grade earned in continuous evaluation (**paragraph 1.i**) will be the same in the two examination periods of the present academic year.

- To pass the subject it will be necessary: (1) To get at least 3 of the 7 points corresponding to the final exam; and (2) to get a final grade (Continuous evaluation + Final Exam + Interdisciplinary Seminar) equal or greater than 5.

In case a student doesn't pass the subject, **the mark obtained in the interdisciplinary seminar will be the only one saved for the next academic year.**

REFERENCES

Basic

- Milton, J.S. (2001). Estadística para Biología y Ciencias de la Salud. Madrid: Ed. Interamericana-McGraw-Hill. 3ª Edición.

- Quinn, Gerry P. y Keough, Michael J. (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press.

- Samuels, M.L. & Witmer, J.A. (2003). Statistics for the Life Sciences.(Third Ed.) San Francisco, CA: Dellen Publishing Company. CD-Rom incluido.

Additional

- Hawkins, D. (2005) Biomeasurement, Understanding, analysing, and communicating data in the biosciences. Oxford University Press.
- Sokal, R.R. & Rohlf, F.J. (1995). Biometry: the principles and practice of statistics in biological research. 3rd edition. W. H. Freeman and Co.: New York.
- http://udel.edu/~mcdonald/statintro.html