COURSE DATA

Data Subject	
Code	34166
Name	Probability
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	3	First term
1928 - D.D. in Physics-Mathematics	Double Degree Program Physics and Mathematics	4	Second term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	10 - Probability and statistics	Obligatory
1928 - D.D. in Physics-Mathematics	4 - Cuarto Curso (Obligatorio)	Obligatory

Coordination

Name	Department
AYALA GALLEGO, GUILLERMO	130 - Statistics and Operational Research
LEON MENDOZA, MARIA TERESA	130 - Statistics and Operational Research
SANTONJA GOMEZ, FRANCISCO JOSE	130 - Statistics and Operational Research

SUMMARY

The Probability is the part of Mathematics that deals with the formal study of uncertainty. Our world is full of elements with uncertainty: accidents, epidemics, storms, climate change, financial market movement, migration, disease, and so on. And it's also full of data. Probabilistic models are key for analysing data and making scientifically sound predictions and estimates. Probability is the basis of stochastic simulation and provides reference tools for the treatment of uncertainty and randomness in territories such as artificial intelligence or data science.

This subject is dedicated exclusively to the learning of Probability. The subject uses in the theoretical classes the traditional format "definition-theorem-proof" that guarantees the rigorous and mathematically precise introduction of the material, but will always be accompanied by an intuitive and critical explanation that enhances the map of probabilistic concepts and the relationship between them. The practical classes and seminars give full prominence to the students with the aim that they can consolidate the learning of the subject.

The course covers all the basic concepts of probability, including the axiomatic definition of probability and its frequency interpretation, random variables and vectors and associated basic characteristics, the main probabilistic models and their usefulness as models for others. disciplines that are essential in their scientific studies.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Necessary: Análisis Matemático I , convenient: Análisis Matemático II

OUTCOMES

1107 - Degree in Mathematics

- Possess and understand the mathematical knowledge.
- Apply the knowledge in the professional world.
- Argue logically in decision-making.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.
- Participate in the implementation of software and learn mathematical software.

LEARNING OUTCOMES

The learning outcomes for this Probability course are:

- Express variability through probability distributions.
- Formulate the possibility of occurrence of an event in probabilistic terms.
- Obtain probabilities of distributions using computer applications.
- Calculate probabilities of random vectors over simple geometric regions.

DESCRIPTION OF CONTENTS

1. Experiment and probability

1.1. Random experiment.
1.2. Measure of probability. Probability space.
1.3. Basic properties of Probability.
1.4. Conditional probability. Independence.
1.5. Total probability and Bayes theorems.

2. Random variables

2.1. Random variable: definition and properties.
2.2. Discrete and continuous distributions of random variables.
2.3. Cumulative distribution function.
2.4. Expectation, variance and standard deviation. Other moments.
2.5. Function of a random variable.

3. Special distributions.

3.1. Discrete distributions: Bernouilli, binomial, negative binomial, hypergeometric and Poisson.
3.2. Continuous distributions: Uniform, exponential and gamma.
3.3. Normal and derived distributions.
3.4. Random variables simulation.

4. Random vectors.

4.1. Random vector. Definition and properties.
4.2. Continuous and marginal distributions. Independence of random variables.
4.3. Conditional distribution.
4.4. Expectation, variance, covariance and correlation. Moments
4.5. Functions of random vectors.

5. Convergence of sequences of random variables.

5.1. Weak convergence in probability and almost sure.
5.2. Weak and strong law of large numbers.
5.3. Central limit theorem.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	37,50	100
Computer classroom practice	22,50	100
Other activities	7,50	100
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	10,00	0
Readings supplementary material	2,50	0
Preparation of evaluation activities	20,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Lectures. Exposition of the concepts with the enrollment of the student by solving punctual questions.

Practical activities. Learning by solving problems, exercises and lab work in which competences will be acquired on the different aspects of the subject. These activities will be developed individually or in small groups.

EVALUATION

The evaluation of the knowledge and competences achieved by the students will be carried out continuously throughout the course, and will consist of the following evaluation blocks:

1. 30% for continuous assessment tests: activities carried out in seminars, in practice sessions or at home.

2. 70% for the final exam, with theoretical and practical content, in which it will be necessary to obtain at least a grade of 5 out of 10 to pass the subject.

The total grade must be greater than or equal to 5 to pass the course.

The criteria to obtain the final qualification will be the same in the first and second call. Seminar/tutoring activities and continuous assessment tests will not be recoverable for the second call.

REFERENCES

Basic

- G. Ayala y F. Montes. Probabilidad básica (2023).
- D. Stirzaker. Elementary Probability. Cambridge. Second Edition (2010)
- Jim Pitman. Probability. Springer-Verlag (1993)
- Sheldon Ross. A First Course in Probability (8th Edition). Pear-son Prentice Hall, 2009.

Additional

- G.R. Grimmett and D.R. Stirzaker.One Thousand Exercises in Probability.Oxford University Press. Third edition (2020).
- S. M. Ross. Introduction to Probability Models. Twuelfth Edition. Academic Press. (2019)
- Gazi, Orhan Introduction to Probability and Random Variables 2023 Springer Nature Switzerland.