COURSE DATA

Data Subject	
Code	36581
Name	Mathematical analysis I F-M
Cycle	Grade
ECTS Credits	12.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1928 - D.D. in Physics-Mathematics	Double Degree Program Physics and Mathematics	1	Annual

Subject-matter

Degree	Subject-matter	Character
1928 - D.D. in Physics-Mathematics	1 - Primer Curso (Obligatorio)	Obligatory

Coordination

Name	Department
FALCO BENAVENT, FRANCISCO JAVIER	15 - Mathematical Analysis
MARTINEZ CENTELLES, JOSEP	15 - Mathematical Analysis

SUMMARY

The first course in mathematical analysis aims to study the real functions of one real variable, Its first need is the knowledge of the real numbers.

Its essential core is the differential and integral calculus, and around this core are configured other elements that give consistency and foundation or which serve to illustrate the great utility for a variety of issues, concepts and techniques developed in the subject.

The course deepens, bases and complete knowledge that students have on this subject and provides the basis and tool for the study of other more advanced topics such as the Geometry, Applied Mathematics and Statistics, to be addressed in subsequent courses.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

As requirements for studying this subject, it is assumed that the student knows the contents of HIGH SCHOOL MATHEMATICS I AND II

OUTCOMES

LEARNING OUTCOMES

According to the Plan document of the studies defined the Degree, Mathematic Analysis I Course is to enable the acquisition of the following competencies:

SPECIFIC (numbering is maintained from the original document).

- Specific competence1. Manipulating inequalities, analyze functions, relate the properties of a function and its graph.
- Specific competence 2. To work intuitively with geometric and formal notions of limit, derivative and integral.
- Specific Competence 3. To know the basic techniques for calculating primitives (change of variable, integration by parts, integration of rational functions), and its application to the calculation of definite integrals.
- Specific competence 4. To use the concepts of derivate and integral in specific applications to other fields of knowledge.
- Specific competence 5. To solve practical problems that involve calculating integrals and optimizing functions.
- Specific competence 6. To know formally correct definition of the most relevant concepts (convergence, limit, continuity, differentiability, integrability).
- Specific competence 7. To know proofs, formally correct, on the most relevant results.

DESCRIPTION OF CONTENTS

1. The real number system and the real line

Introduction to the set of real numbers. The axiom of supreme. Order, intervals, absolute value. Nested intervals Theorem. Set cardinality. Cantor's diagonalization method.

2. Sequences of numbers

convergence, monotony and boundedness. The number e. Subsequences and Bolzano-Weierstrass theorem. Stolz criterion.

3. Functions of one real variable. Continuity

Introduction to the concept of real function of real variable. Graph. Elementary functions and their representations. Inverse functions Continuity and limits of functions defined on intervals. Lateral concepts. Infinite limits. Continuity theorems: Bolzano, Weierstrass. Uniform continuity.

4. Integration of functions of a real variable

Concept of derivative of a function in a point. Geometric interpretation. Side Derivatives. Algebra of derivatives. Chain rule. Implicit and parametric derivation. The concept of differential and its geometric interpretation. Rolle and Mean Value Theorems. Bernouilli-LHôpital rules. Successive derivatives. Taylor and McLaurin theorems. Extremes of functions, optimization. Convex functions. Graphical representation of functions.

5. Integration of functions of a real variable

Introduction to the Riemann integral by the Darboux method. Properties of the integral. Integrability of continuous and monotonous functions. Fundamental theorem of integral calculus. Barrow Rule

6. Primitive

Calculation of primitives, immediate integrals. Integration methods. Improper integrals: convergence criteria. Geometric applications of the integral: areas of figures. Volumes of revolution. Curve Lengths.

7. Numerical series

Series. Cauchy convergence criteria. Concept of summable succession and convergent series. Absolute convergence. Series with positives terms. Root and quotient tests. Alternated series. Sums.

8. Power series

Power series. Convergence radius Taylor series: convergence and estimation of the rest.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	60,00	100
Classroom practices	45,00	100
Other activities	15,00	100
Attendance at events and external activities	15,00	0
Development of group work	15,00	0
Development of individual work	15,00	0
Study and independent work	35,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	37,50	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	2,50	0
Resolution of case studies	25,00	0
Resolution of online questionnaires	5,00	0
TOTAL	**285,00**	

TEACHING METHODOLOGY

1 To be gradually introduced and develop the theoretical and practical contents of each topic and the right tools to solve problems.

2 In the practical sessions we will apply the concepts presented in lectures to solve problems.

3 Questions and problems will be proposed. This study will be supervised and evaluated. In the practical sessions we shall solve and correct exercises.

4 It will use a symbolic computation software package that helps both conceptual understanding and visualization. It will also serve as a testing method to provide intuitive knowledge.

EVALUATION

Evaluation will consists of the following three ítems:

1) Item 1: Written exams will be measured both the acquisition of

Knowledge, writing ability and rigor in proofs at the theoretical part as well as the ability to solve problems and exercises at the practical part.

Theoretical and practical parts will provide each fifty

percent of the note provided that each note becomes equal or greater than three out of ten. Otherwise, the note of the exam will be the minumum between the average and 3,9.

There will be two exams throughout the course, at the end of each semester. The note of each of the partial exams must be greater or equal to four out of ten.

To pass one must obtain a minimum grade of 4 out of 10 on this item. This ítem counts 80% of the final grade.

2) Item 2: Participation in the taskes proposed by the teacher and controls.

3) Item 3: Participation in the seminars.

Marks corresponding to ítems 2 and 3 count each one 10% of the final grade and are considered not-recoverable, that is, they cannot be evaluated by an exam. The marks will be kept for the whole academic year.

REFERENCES

Basic

- Referencia b1: S. Abbott; Understanding analysis, Undergraduate Texts in Mathematics, Springer, New York, 2015

  Referencia b2: Bartle, R.; Sherbert, D.R.: Introducción al Análisis Matemático de una variable, Ed. Limusa, 1996.

  Referencia b3: Spivak, M.: Calculus, Editorial Reverté, 2012.

  Referencia b4: Tao, T. ;Analysis I, Texts and Readings in Mathematics, 37, Hindustan Book Agency, New Delhi, 2009.

Additional

- Referencia c1: Apostol, T.M.; Análisis matemático, Ed. Reverté, 1977

  Referencia c2: Demidovich, B. ; 5000 problemas de Análisis matemático. Ed Reverté, 1982

  Referencia c3: Stromberg, K.: Introduction to classical real analysis. Wodsworth International Mathematics Series, Belmont, Calif., 1981.