COURSE DATA

DATA SUBJECT

Code: 36581
Name: Mathematical Analysis I P-M
Cycle: Undergraduate Studies
ECTS Credits: 12
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1928 - Double Degree Program Physics-Mathematics	Facultat de Ciències Matemàtiques	1	Annual

SUBJECT-MATTER

Degree	Subject-matter	Character
1928 - Double Degree Program Physics-Mathematics	Primer Curso (Obligatorio)	COMPULSORY

COORDINATION

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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

COMPETENCES / LEARNING OUTCOMES

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

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	60,00
Other activities	15,00
Classroom practices	45,00
Total hours	**120,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	15,00
Individual or group project	30,00
Independent study and work	55,00
Preparation of lessons	12,50
Preparation for assessment activities	42,50
Resolution of case studies	25,00
Total hours	**180,00**

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, writting 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.

Students taking the final exam for the entire subject, in order to pass Block 1, must not only obtain a minimum score of 3 out of 10 in each of the theory and practical sections, but also obtain a minimum grade of 4 out of 10 by calculating the arithmetic average of the theory and practical sections for each semester. Otherwise, the exam grade will be the lower of the student's grade and a 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

- Abbott, S.: Understanding analysis, Undergraduate Texts in Mathematics, Springer, New York, 2015.
- Bartle, R.; Sherbert, D.R.: Introducción al Análisis Matemático de una variable, Ed. Limusa, 1996.
- Spivak, M.: Calculus, Editorial Reverté, 2012.
- Tao, T.: Analysis I, Texts and Readings in Mathematics, 37, Hindustan Book Agency, New Delhi, 2009.

Additional Bibliography

- Apostol, T.M.: Análisis matemático, Ed. Reverté, 1977.
- Demidovich, B.: 5000 problemas de Análisis matemático. Ed Reverté, 1982.
- Stromberg, K.: Introduction to classical real analysis. Wodsworth International Mathematics Series, Belmont, Calif., 1981.