COURSE DATA

Data Subject

Code	36590
Name	Variable compleja
Cycle	Grade
ECTS Credits	7.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1928 - Double Degree Program Physics-Mathematics	Double Degree Program Physics and Mathematics	3	First term

Subject-matter

Degree	Subject-matter	Character
1928 - Double Degree Program Physics-Mathematics	3 - Tercer Curso (Obligatorio)	Obligatory

Coordination

Name	Department
MAZON RUIZ, JOSE M	15 - Mathematical Analysis

SUMMARY

The aim of this course is to introduce students to the theory of differentiable functions of complex variable, showing its main properties and applications: Cauchy's theorem and the residue theorem, its application to the calculation of real integrals and the sum of series as well as Laplace transform and its aplications to solve differential equations.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Understanding the concepts of pointwise convergence and uniform convergence and uniform convergence identified by the criterion M series of Weiestrass.

Understand the basics of complex functions.

Know the essential differences between the calculation with real functions and complex functions.

Using the relationship between holomorphic and analytic functions.

Calculate residues and use them for determination of real integrals and series.

Know Laplace transform and its applications to solve differential eq

DESCRIPTION OF CONTENTS

1. Power series

Sequences and series of functions. Uniform convergence. The criterion M series of Weiestrass
Power series, radius of convergence. Differentiability of power series.

2. Elementary functions

The exponential functions, sinus, cosinus and the hyperbolic functions: definition and properties. Euler identities. Existence of continuos arguments and logarithms.

3. Conmplex integration

Paths. Integral of a continuos functions along a path. Existence of primitives. The fundamental theorem of Calcules. Starlike sets. Cauchy-Goursat theorem.

4. Cauchy integral formula

Cauchy integral formulas. Taylors theorem. Cauchy inequalities.

5. Consequences of the Cauchy integral formula

The theorems of Morera, Liouville and the fundamental theorem of algebra. Zeros of holomorphic functions. Analytic continuation principle. Maximum modulus theorem. Weiestrass theorem. General Cauchy theorem.

6. Singularities and series of Laurent

Isolated singularities. Laurent series. Classification of singularities. Casorati-Weierstrass theorem.

7. Residue theorem

Residue theorem and its consequences: the argument principle, open maping theorem, Rouchés theorem.
Applications to integrals and series.

8. Laplace transform

Laplace transform: definition and properties. Abscissa of convergence. Inversion formula. Aplication of resolution of differential equations.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Classroom practices	28,00	100
Other activities	9,00	100
Development of individual work	5,00	0
Study and independent work	35,00	0
Preparation of evaluation activities	37,50	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	25,00	0
TOTAL	**187,50**	

TEACHING METHODOLOGY

a. The theoretical and practical contents of each topic and the right tools to solve problems will be introduced and developed gradually.

b. Concepts presented in theoretical sessions will be applied to solve problems in the practical sessions.

c. Proposed questions and problems for study. This study will be supervised and evaluated. In the practical sessions we will solve and correct exercises.

EVALUATION

Each student must show knowledge of basic concepts, skills and competences of the subject by means of theoretical and practical examinations. Also be assessed its capacity to address issues or resolve the problems posed by the teacher.

Evaluation will be ruled by the following criteria:

1) Written theory exams that will measure both the acquisition of knowledge and writing ability and rigor in proofs. Written practice exams will evaluate the ability to solve problems and exercises. Along the course there will be a control and a final examination. Either in the control and in the examination there will be a theoretical and a practical part which will contribute each fifty percent of the grade, provided that each grade is greater than or equal to three out of ten. In the case that any of the grades does not reach more than three points, the grade of the examination/control will be the minimum of the grade average and four. The final grade will be the average of the grade of both parts.

2) The control means 10% of the final grade.

3) Participation in the seminars and in the tasks proposed by the teacher will be another 10% of the final grade.

4) The grades corresponding to the continuous evaluation will be kept in the two calls for the academic year in which they have been made, since their evaluation is only possible throughout the semester and not in the extraordinary session.

REFERENCES

Basic

- JAMESON, G.O.J. Un primer curso de funciones complejas. Compañia Editorial Continental, 1973
- STEIN, E.M., SHAKARCHI, R. Complex Analysis Princeton Lectures in Analysis, 2003.
- REMMERT,R. Theory of complex functions 122 Graduate Yext in Mathematics, Springuer-Verlag, 2012

- GALINDO,F.,GÓMEZ, J. SANZ, J., TRISTÁN, L.A. Guía práctica de Variable Compleja y aplicaciones. Universidad de León, Universidad de Valladolid, 2019.
- VERA, G. Variable compleja, problemas y complementos. Electrolibris, 2013.

Additional

- ASH, R.B. Complex Variables Dover Publications Inc., 2007
- BRUNA,J., CUFÍ,J. Complex Analysis : European Mathematical Society, 2013.