COURSE DATA

DATA SUBJECT

Code: 36590
Name: Complex Variable
Cycle: Undergraduate Studies
ECTS Credits: 7.5
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1928 - Double Degree Program Physics-Mathematics	Facultat de Ciències Matemàtiques	3	First quarter

SUBJECT-MATTER

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

COORDINATION

MAZON RUIZ JOSE M

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 / LEARNING OUTCOMES

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.

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

8. Laplace transform

resolution of differential equations.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	38,00
Other activities	9,00
Classroom practices	28,00
Total hours	**75,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	5,00
Independent study and work	35,00
Preparation of lessons	35,00
Preparation for assessment activities	37,50
Resolution of case studies	0,00
Total hours	**112,50**

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

- 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.

- ASH, R.B. "Complex Variables" Dover Publications Inc., 2007

- BRUNA,J., CUFÍ,J. "Complex Analysis" : European Mathematical Society, 2013.

- MAZON J.M., Funciones de Variable Compleja. Teoría y Problemas. Amazon, 20211. xviii+411 pp. ISBN: 9798506409052.

- CONWAY, J.B. "Functions of One Complex Variable". Springer. 1978