VNIVERSITAT Ğ ID VALÈNCIA

# COURSE DATA

## Data Subject

| | |
|---|---|
| **Code** | 34158 |
| **Name** | Mathematical analysis IV |
| **Cycle** | Grade |
| **ECTS Credits** | 9.0 |
| **Academic year** | 2022 - 2023 |

## Study (s)

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1107 - Degree in Mathematics | Faculty of Mathematics | 4 | First term |

## Subject-matter

| Degree | Subject-matter | Character |
|---|---|---|
| 1107 - Degree in Mathematics | 6 - Mathematical analysis | Obligatory |

## Coordination

| Name | Department |
|---|---|
| BLASCO DE LA CRUZ, OSCAR FCO. | 15 - Mathematical Analysis |
| GALINDO PASTOR, PABLO | 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 and its application to the calculation of real integrals and the sum of series.

VNIVERSITAT Đ VALÈNCIA

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

Linear Algebra and Geometry I and  Mathematical Analysis I, II, III.

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

### 1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Solve problems that require the use of mathematical tools.
- Ability to work in teams.
- Learn autonomously.
- Possess and understand the mathematical knowledge.
- Expressing mathematically in a rigorous and clear manner.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.
- Visualize and interpret the solutions obtained.

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

The student will understand the concepts of pointwise convergence and uniform convergence and identify uniform convergence of series using the criterion M-Weierstrass.

He/She should become familiar with the basics of the complex variable.

He/She must know how to use the relationship between holomorphic and analytic functions.

He/She should know how to calculate residues and use them for evaluating real integrals.

## DESCRIPTION OF CONTENTS

### 1. The fiel of complex numbers.

### 2. Derivation of complex functions. Cauchy-Riemann equations.

### 3. Real and complex powers series Pointwise and uniform convergence.

### 4. Complex integration. Cauchy's integral theorem. Taylor series.

### 5. Singularities. Residue theorem.

### 6. Applications.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theory classes | 56,00 | 100 |
| Classroom practices | 34,00 | 100 |
| Other activities | 11,00 | 100 |
| Development of group work | 7,00 | 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 | 35,50 | 0 |
| Preparing lectures | 10,00 | 0 |
| Preparation of practical classes and problem | 14,50 | 0 |
| Resolution of case studies | 10,00 | 0 |
| **TOTAL** | **233,00** | |

## TEACHING METHODOLOGY

a. The aim is to gradually introduce and develop the theoretical and practical content of each topic and the right tools to solve problems.

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

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

- Referència b1:   ASH, R.B. "Complex Variables". Academic Press 1971

Referència b2:   JAMESON, D.J.O. "A First Course on Complex Analysis". Chapman and Hall Mathematics Series. Springer-Verlag,  1970

Referència b3:   MARSDEN, J.E., HOFMAN, J.J. "Basic Complex Analysis" W.H.Freeman and Co. 1970

Referència b4:   MAZON J.M., Funciones de Variable Compleja. Teoría y Problemas. Amazon, 20211. xviii+411 pp. ISBN: 9798506409052

Referència b5:   PALKA, R.P. "Introduction to Complex Function Theory" Springer. 1991

Referència b6:   KRZYZ, J.G. "Problems in Complex Variable Theory". American Elsevier Pub. Co., 1971

## Additional

- Referencia c1:   BURCKEL, R.B. "An introduction to Classical Complex Analysis). Academic Press. 1979.

Referencia c2:   CONWAY, J.B. "Functions of One Complex Variable".Springer. 1978

Referencia c3:  RAO, M., STETKAER, H. ``Complex Analysis. An invitation".
World Scientific, 1991.

Referencia c4:   RUDIN, W. "Real and Complex Analysis" Mc Graw Hill 1977

Referencia c5:  WUNSCH, A.D. Variable compleja con aplicaciones. Add. Wesley Iberoamericana. Segunda edición, 1997.