COURSE DATA

Data Subject	
Code	34156
Name	Mathematical analysis II
Cycle	Grade
ECTS Credits	12.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	2	Annual

Subject-matter

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

Coordination

Name	Department
MARTINEZ CENTELLES, JOSEP	15 - Mathematical Analysis
MAZON RUIZ, JOSE M	15 - Mathematical Analysis

SUMMARY

The domain of the differential and integral calculus of functions of several real variables is one of the foundations of mathematics training. One of the objectives of the second degree course must be the conceptual understanding and fluency in the use of basic techniques of this matter.

The course is divided into two parts, each one is studied in a semester. In the first part we study Differential Calculus, which is developed for functions defined in finite dimensional Euclidean spaces. The second part of the course is devoted to the study of the Lebesgue integral

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, Mathematical Analysis I

OUTCOMES

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

According to the plan document of the Degree in Mathematics, Mathematical Analysis II is to enable the acquisition of these skills.

SPECIFIC (numbering is kept the original document)

Specific competence 1: Calculate limits of functions of several variables and identify differentiable functions.
Specific Competence 2: Manage the partial derivatives using chain rule and implicit function theorem.
Specific Competence 3: Know the formulation of equations of mathematical physics through partial derivatives.
Specific Competence 4: Study local extrema and extrema subject to constraint of functions of several variables.
Specific Competence 5: Apply the inverse function theorem and Implicit function theorem to

specific problems.
Specific Competence 6: Understand the concept of convergence of improper integrals and know the main convergence criteria.
Specific Competence 7: Know how to identify Lebesgue integrable functions.
Specific Competence 8: Apply the main theorems of convergence.
Specific Competence 9: Know the formulation of the theorems of Fubini, the change of variable, and how to apply them for handling integration.
Specific Competence 10: Relate the concept of a measure with that of integration.
Specific Competence 11: Solve problems involving the integral approach (lengths, areas, volumes and centers of gravity).

DESCRIPTION OF CONTENTS

1. Limits, continuity and differentiability of functions of several variables.

2. Derivatives of higher order. Taylor´s formula and local extrem of functions of several variables.

3. The inverse function theorem and implicit function theorem.

4. Extrema with constraints and Lagrange multipliers.

5. Lebesgue integrable functions.

6. Convergence theorems.

7. Fubini´s Theorem.

8. Measurable functions and Lebesgue measure.

9. Criterion of integrability of Tonelli.

10. The change of variable formula.

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

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

d. Use a symbolic computation software package that helps in the conceptual understanding and visualization. It will also serve as a testing method to provide intuitive knowledge

EVALUATION

Each student will demonstrate 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 conducted by

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. There will be two exams throughout the course (middle and end of course). In each exam there will be a theoretical and a practical part which will contribute each fifty percent of the note provided that each note is greater than or equal to three out of ten. The note of each of the partial exams must be greater or equal to four out of ten.

2) Participation on the tasks or controls proposed by the teacher will be evaluated (10%), provided that the obtained mark is above a minimum of four points.

3) Participation in the seminars will be evaluated (10%), provided that the obtained mark is above a minimum of four points.

REFERENCES

Basic

- Apostol, T.M., Análisis Matemático, Editorial Reverté, 1977
- Mazón, J. M, Cálculo diferencial: Teoría y problemas., PUV Laboratori de Materials, 17. 2008
- Mazón, J.M. La Integral de Lebesgue en RN . Teoría y Problemas . PUV Laboratori de materials 71. 2016
- Ortega, J.M. Introducciò a lAnàlisi Matemàtica. Manuals de la Universitat Autònoma de Barcelona , 1993

Additional

- Stromberg, K. An introduction to Classsical Real Analysis, Wordswoth Int. Math. Series, 1981.
- Bressoud, David, Second Year of Calculus, Ed. Springer-Verlag, 1991.
- Weir, A.J. Lebesgue Integration and Measure, Cambridge University Press, 1973.