SUBJECT TEACHING GUIDE

G44 - Integral Calculus

Double Degree in Physics and Mathematics
Degree in Mathematics

Academic year 2026 - 2027

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Mathematics			Type and Year	Core. Year 1 Core. Year 1
Faculty	Faculty of Sciences				
Discipline	Subject Area: Basic Mathematics Basic Module				
Course unit title and code	G44 - Integral Calculus				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Knowledge Field	Mathematics and statistics				
Web	https://moodle.unican.es				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	BEATRIZ PORRAS POMARES
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Office	Facultad de Ciencias. Planta: + 3. DESPACHO (3019)
Other lecturers	

4. OBJECTIVES

The Integral Calculus course in the first year of the Mathematics degree links the basic knowledge from pre-university education, focused on finding antiderivatives, with the fundamentals of the Riemann Integral and its construction in one and several variables. Based on calculus problems, the elementary properties and the challenges that will be addressed with proofs of the classic theorems of real analysis in one and several variables in the Advanced Integral Calculus course in the second year are gradually introduced.

Considering that the subject is also taught as part of the Physics degree program for dual-degree students, it covers the calculation of multivariable integrals and some applications like integrals over curves and surfaces, which are necessary for continuing their studies in this degree.

6. SUBJECT PROGRAM

CONTENTS	
1	The Riemann integral for functions of a real variable. - Construction and properties. Riemann sums. - Fundamental Theorems. Change of variable. Relation to the calculation of antiderivatives. - Applications: calculating areas, mean value, differentiation of integrals. - Improper integrals. Convergence criteria.
2	Riemann integral of real functions of several variables. - Construction. Riemann's criterion. Properties. - Iterated integrals: Fubini's theorem. Integrals defined on other bounded sets. Elementary regions. Cavalieri's principle. - Change of variables. Polar coordinates. Cylindrical and spherical coordinates. - Some applications: areas, calculation of volumes of solids of revolution, average value, centers of gravity, etc.
3	Vector calculus. - Regular and simple curves. Piecewise regular curves. Closed curves. Oriented curves. - Curve length. - Line integrals of scalar and vector fields. Green's theorem. - Regular and simple surfaces. Oriented surfaces. - Surface area. - Surface integrals of scalar and vector fields. Gauss and Stokes' theorems.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessment	%
Partial Exam 1. Evaluates the first block of the course.	Written exam	No	Yes	35,00
Partial Exam 2. Evaluates the second block of the course.	Written exam	No	Yes	40,00
Partial Exam 3. Evaluates the third block of the course.	Written exam	No	Yes	25,00
TOTAL				100,00

Observations

Continuous evaluation (ordinary call):
1st Partial
2nd Partial + first partial recovery
3rd Partial + second partial recovery

Extraordinary call: recovery of each of the partials

Observations for part-time students

Part-time students can choose to take a single final assessment through an exam that counts for 100% of the grade, by agreeing on it with the teacher at the start of the course.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

E. Marsden y A.J. Tromba, Vector Calculus. Sixth Edition. W. H. Freeman and Company Publishers

M. Spivak, Calculus. Editorial Reverté

B. Demidovich, Problemas y ejercicios de Análisis Matemático. Editorial Paraninfo. Madrid.