UNIVERSIDAD DE MURCIA

FACULTY OF MATHEMATICS

Functions of several real variables 1

Syllabus

Course code:	1578
Number of ECTS credits:	6
Semester:	1st (September-January)
Prerequisites:	None
Recommended components:	Linear Algebra (1569), Functions of one real variable (1568 and 1573), Affine and Euclidean Geometry (1574) and Topology of metric spaces (1575)
Language of instruction:	Spanish

Course description

During the second year of the degree the students will study functions of several real variables. This topic has been divided into three parts. In this first part we shall deal with differentiability vs. directional derivatives, Taylor's formula and optimizing functions with and without constraints. To reach this goal we shall study the topology of normed vector spaces (mainly $\mathbb{R}^n$ although we shall also pay attention to the space $(C([a,b]), \|\cdot\|_\infty)$ of continuous real valued functions).

Learning outcomes and competences

After completion of this course you will:

1. be familiar with several types of convergence in the space of continuous functions.
2. know the difference between differentiability and partial derivatives and their relation.
3. know how to use the chain rule of differentiation.
4. know how to find the extreme values of a real function with and without constraints.

Course contents

I. Normed spaces, convergence and continuity

Normed spaces. Pointwise and uniform convergence of sequences of functions. Limits and continuity.

II. Vector valued functions of one variable.

Speed and arc length. The finite-increment theorem.

III. Differentiation in several variables.

Directional derivatives, partial derivatives and differentiability. The chain rule. Gradients y tangent planes.

IV. Higher order derivatives.

Equality of mixed partials. Taylor's formula

V. Optimization.

Local extrema: the second derivative test. A quick glance at the implicit function theorem. Optimizing with constraints: Lagrange multipliers. Global extrema.

References

1. Edwards, C. H. *Advanced Calculus of Several Variables*, Dover.
2. Fernández Viña, J. A. *Análisis Matemático II*, Tecnos.
3. Rogawski, J. *Calculus. Second Edition*, W. H. Freeman and Company.
4. Vera, G. *Lecciones de Análisis Matemático II*. http://ocw.um.es/ciencias/analisis-matematico-ii