Course guide
390462 - DAV - Data Analysis and Visualization

Last modified: 12/01/2026

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AGRONOMIC SCIENCE ENGINEERING (Syllabus 2018). (Optional subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: Blanco Abellan, Monica

Others: Blanco Abellan, Monica
Casals Missio, Joan

REQUIREMENTS

Students should have passed the cours Statistics (Q3).

TEACHING METHODOLOGY

A combination of lectures, problem solving and computer labs sessions (Minitab, spreadsheet, R), discussion of scientific papers and oral presentations.

LEARNING OBJECTIVES OF THE SUBJECT

1. To analyse large sets of variables by means of multivariate techniques.
2. To design and analyse experiments to improve the quality of a process.
3. To identify the significant effects and interactions in factorial designs.
4. To analyse the work conditions to obtain the best possible answer using the techniques of response surface.
5. To connect and use old statistical knowledge to develop new concepts and techniques.
6. To get acquainted with a number of statistical software packages to carry out data analysis and visualization, multivariate analysis and experimental designs.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	40,0	26.67
Hours small group	20,0	13.33
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

INTRODUCTION TO MULTIVARIATE ANALYSIS

Description:
1.1. The analysis of variance: with a single factor; with two factors.
1.2. Relationships between sets of variables: multiple linear regression.
1.3. Ordination, or dimension reduction, techniques: principal components analysis.
1.4. Grouping data techniques: cluster analysis.

Full-or-part-time: 20h
Theory classes: 14h
Practical classes: 6h

TWO-LEVEL FACTORIAL DESIGNS

Description:
2.1. Introduction to two-level factorial designs (2k).
2.2. Calculation of effects. Determination of the significance of effects.
2.3. Interpretation.

Full-or-part-time: 10h
Theory classes: 7h
Practical classes: 3h

RESPONSE SURFACE METHODOLOGY: AN INTRODUCTION

Description:
3.1. Introduction to response surface methodology. The method of steepest ascent. Designs for fitting first-order and second-order models.
3.2. Central composite designs.
3.3. Contour plots and canonical analysis. Interpretation.

Full-or-part-time: 10h
Theory classes: 7h
Practical classes: 3h

DATA ANALYSIS AND VISUALIZATION WITH R

Description:
4.1. Introduction to R software and the RStudio environment
4.2. Format, structure, and typology of datasets in R
4.3. Visualization of categorical and quantitative data
4.4. Univariate and multivariate visualization
4.5. Types of descriptive graphics according to the nature of the data
4.6. Data visualization with ggplot2 and ggpubr packages
4.7. Graphical representation of multivariate statistical analysis with FactoMineR
4.8. Customizing graphics: themes, color palettes, and other graphic elements
4.9. Graphic design and composition (layouts)
4.10. Models of graphical representation in scientific literature
4.11. Best practices in data visualization

Full-or-part-time: 20h
Theory classes: 12h
Practical classes: 8h

GRADING SYSTEM

N1: written examn
N2: written exam
NC: Coursework

Final Grade = 0,5*NC + 0,30*N1 + 0,2*N2

BIBLIOGRAPHY

Basic:
- Granato, Daniel; Ares, Gaston. Mathematical and statistical methods in food science and technology. Chichester, West Sussex, UK: John Wiley & Sons Inc, 2014. ISBN 9781118433683.
- Hair, Joseph F. Multivariate data analysis : a global perspective. 7th ed. Upper Saddle River, N.J. etc: Pearson, cop. 2010. ISBN 9780135153093.
- Box, George E. P; Hunter, J. Stuart; Hunter, William Gordon. Statistics for experimenters : design, innovation, and discovery. Second edition. Hoboken, New Jersey: Wiley-Interscience, a John Wiley & Sons, Inc., publication, 2005. ISBN 0471718130.
- Montgomery, Douglas C. Design and analysis of experiments. 3rd ed. New York etc: John Wiley & Sons, cop. 1991. ISBN 0471520004.

Complementary:
- Myers, Raymond H; Montgomery, Douglas C; Anderson-Cook, Christine M. Response surface methodology : process and product optimization using designed experiments. 3rd ed. Hoboken: Wiley, cop. 2009. ISBN 9780470174463.
- Hicks, Charles R; Turner, Kenneth V. Fundamental concepts in the design of experiments. 5th. ed. New York etc: Oxford University Press, cop. 1999. ISBN 0195122739.