Course guide
390450 - ASTAT - Advanced Statistics

Last modified: 26/05/2026

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: **Academic year:** 2026 **ECTS Credits:** 6.0
Languages: English

LECTURER

Coordinating lecturer: MONICA BLANCO ABELLAN

Others:

REQUIREMENTS

Students should have passed the course STATISTICS (Q3).

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to solve mathematic problems in an engineering context . Ability to apply the knowledge of statistics and optimization.

TEACHING METHODOLOGY

A combination of lectures, problem solving and computer labs sessions, and 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 multivariate analysis and experimental designs.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	60,0	40.00

Total learning time: 150 h

CONTENTS

(ENG) 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.

Related activities:
Activities 1, 2, 3, 4.

Full-or-part-time: 68h
Theory classes: 20h
Laboratory classes: 8h
Self study : 40h

(ENG) TWO-LEVEL FACTORIAL DESIGNS

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

Related activities:
Activities 1, 2, 3, 4.

Full-or-part-time: 41h
Theory classes: 10h
Laboratory classes: 6h
Self study : 25h

(ENG) RESPONSE SURFACE METHODS AND DESIGNS

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.

Related activities:
Activities 1, 2, 3, 4.

Full-or-part-time: 41h
Theory classes: 10h
Laboratory classes: 6h
Self study : 25h

ACTIVITIES

ACTIVITY 1: LECTURES

Full-or-part-time: 108h
Theory classes: 38h
Self study: 70h

ACTIVITY 2: INDIVIDUAL WRITTEN TEST

Full-or-part-time: 2h
Theory classes: 2h

ACTIVITY 3: PROBLEM SOLVING AND COMPUTER LABS

Full-or-part-time: 20h
Laboratory classes: 10h
Self study: 10h

ACTIVITY 4: DISCUSSION OF SCIENTIFIC PAPERS AND ORAL PRESENTATIONS

Full-or-part-time: 20h
Laboratory classes: 10h
Self study: 10h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

Final Grade = 0.5 * Coursework (activities 3 and 4) + 0.2 * Mid-Term Exam + 0.3 * Final Exam

EXAMINATION RULES.

.

BIBLIOGRAPHY

Basic:
- Granato, D.; Ares, G.. Mathematical and statistical methods in food science and technology. Wiley-Blackwell, 2014. ISBN 9781118433683.
- Box, George E. P.; Hunter, J. Stuart; Hunter, William Gordon. Statistics for experimenters : design, innovation, and discovery. 2a ed.. Hoboken: John Wiley & Sons, 2005. ISBN 0471718130.
- Hair, Joseph F.. Multivariate data analysis : a global perspective. 7a ed.. Upper Saddle River, N.J. [etc.]: Pearson, 2010. ISBN 9780135153093.
- Montgomery, Douglas C.. Design and analysis of experiments. 3a ed. New York: John Wiley & Sons, 1991. ISBN 0471520004.

Complementary:

- Hicks, Charles R.; Turner, Kenneth V.. Fundamental concepts in the design of experiments. 5a ed. New York: Oxford University Press, 1993. ISBN 0195122739.
- Moore, David S.; McCabe, George P.; Craig, Bruce A.. Introduction to the practice of statistics. 7a ed. New York: W.H. Freeman, 2012. ISBN 9781429286640.
- Myers, Raymond H.; Anderson-Cook, Christine M.; Montgomery, Douglas C.. Response surface methodology : process and product optimization using designed experiments. 3a ed.. Hoboken: Wiley, 2009. ISBN 9780470174463.
- Daniel, Wayne W.. Biostatistics : basic concepts and methodology for the health sciences. 10a ed.. Hoboken: John Wiley & Sons, 2014. ISBN 9781118362204.