

## Course guide

### 390450 - ASTAT - Advanced Statistics

Last modified: 03/06/2024

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

**Degree:** BACHELOR'S DEGREE IN AGRICULTURAL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN AGRICULTURAL, ENVIRONMENTAL AND LANDSCAPE ENGINEERING (Syllabus 2009). (Optional subject).  
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:** 2024    **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

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### 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

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

## EXAMINATION RULES.

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## BIBLIOGRAPHY

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### Basic:

- Granato, D.; Ares, G.. Mathematical and statistical methods in food science and technology. Wiley-Blackwell, 2014. ISBN 9781118433683.
- Montgomery, Douglas C.. Design and analysis of experiments. 3a ed. New York: John Wiley & Sons, 1991. ISBN 0471520004.
- 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.

### 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.