UAB
Universitat Autònoma de Barcelona

Experimental Design

Code: 104862
ECTS Credits: 6

2025/2026

Degree	Type	Year
Applied Statistics	OB	2

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Knowledge in:

- Calculus
- Descriptive Statistics
- Statistical Programming
- Statistical Inference
- Statistical sampling

Objectives and Contextualisation

The objectives of the subject are to learn to design and analyze experiments using the following techniques:

- Analysis of the variance of one and several factors.
- Analysis of the variance with blocks, nested factors, fractional designs with interaction
- Analysis of Covariance and other special designs.

The subject is also intended to familiarize students with the use of SAS software.

Learning Outcomes

1. CM09 (Competence) Assess the suitability of the models with the correct use and interpretation of indicators and graphs.
2. KM12 (Knowledge) Provide the experimental hypotheses of modelling, considering the technical and ethical implications involved.
3. SM12 (Skill) Interpret the results obtained to formulate conclusions about the experimental hypotheses.
4. SM14 (Skill) Use graphs to visualise the fit and suitability of the model.

Content

Principles of Experimental Design.

- Objective
- Hypothesis
- Variables
- Bias control.
- Common designs
- Calculate sample size

Review Inference 1 and 2 populations:

- 1 Sample, known sigma
- 1 Sample unknown sigma
- 2 independent samples known sigma
- 2 independent samples unknown sigma
- 2 paired samples

1: ANOVA 1 Fully Randomized Factor

- Variance decomposition
- Model and ANOVA Table
- Contrasts
- Separation of Means - LSD / Bonferroni / Scheffe / Tukey
- Verification of the model (Levene Test, Waste Chart, Normality)

2: ANOVA 1 Block

- Fixed / Random Factor
- Variance decomposition
- Model and ANOVA Table

3: ANOVA 1 Factor with Complete Blocks

- Model and ANOVA Table
- Verification of the model
- Cross-Over Studies

4: ANOVA 1 Factor Blocks InComplete

- Latin squares
- Model and ANOVA Table

5: ANOVA 2 Factors

- Model and ANOVA Table
- Separation of Means - SNK / Dunnet / Other methods

6: ANOVA 2 Factors with Interaction

- Model and ANOVA Table
- Interactions
- Separation of Means - SNK / Dunnet / Other methods

7: ANOVA with Sub-Replicates

- Model and ANOVA Table

8: ANCOVA

- Model and ANOVA Table

9: ANCOVA with Interactions

- Model and ANOVA Table
- Interactions

10: Other models

- Basic concepts of Screening Design
- Basic Concepts of Factorial Design 2k
- Basic concepts of the Surface Response method

Software

- R
- SAS System
- SAS Enterprise Guide

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Report	20	0.8	
Theory	60	2.4	
Type: Supervised			
Pràctiques	25	1	

Concepts related to the design of studies and experiments will be exposed in theoretical sessions.

These sessions will be complemented by practical sessions in a computer lab, where datasets will be analyzed using statistical software.

All the above concepts will be applied through an experimental project that can be carried out in groups.

Regarding the use of artificial intelligence tools, they are only permitted for reviewing the text of the reports, both for the practical sessions and the final project.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam	50	15	0.6	CM09, KM12, SM12, SM14

Intermediate Exam	15	10	0.4	CM09, KM12, SM12, SM14
Practical Sessions	10	10	0.4	SM12, SM14
Report	25	10	0.4	CM09, KM12, SM12, SM14

Continuous Assessment:

Project: 25%
Practices: 10%
Midterm Exam: 15%
Final Exam: 50% (Minimum grade: 4)

Reassessment:

The final grade will be the higher of the following two options:

Reassessment Exam: 100%
Project: 30% + Reassessment Exam: 70% (Minimum grade: 4)

Single Assessment:

Students who opt for the single assessment modality must take a final test consisting of:

A written exam with theoretical questions and problem-solving. A practical exam conducted on a computer This test will take place on the same day, time, and location as the Final Exam. Students who do not attend this test without a justified reason will receive a grade of NOT ASSESSED.

If the grade obtained is below 5, the student may retake the exam on the same day, time, and location as the Reassessment Exam.

Bibliography

References

- Estadística para investigadores - Box, Hunter, Hunter - Ed. Reverté
- Estadística. Modelos y Series Temporales. Daniel Peña - Ed. Alianza
- Principles and procedures of statistics, a biometrical approach 2nd Ed - Steel, Torrie - McGraw Hill
- Biostatistics: A foundation for analysis in the health sdciences. 4th Ed - Steel, Torrie - John Willey & Sons
- Design and Analysis of Experiments - Dean , Voss - Springer-Verlag New York, 1999
- Peña, D. (1998) Estadística. Modelos y Métodos. Tomo I: Fundamentos. Alianza Universidad Textos.
- Montgomery, DC. (2001). Design and Analysis of Experiments. John Willey and sons.

Software

SAS and R

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	second semester	afternoon
(PLAB) Practical laboratories	1	Catalan	second semester	afternoon
(PLAB) Practical laboratories	2	Catalan	second semester	afternoon
(TE) Theory	1	Catalan	second semester	afternoon