

Experimental Design

Code: 104862
ECTS Credits: 6

2024/2025

Degree	Type	Year
2503852 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. CM09 (Competence) Assess the suitability of the models with the correct use and interpretation of indicators and graphs.
3. CM10 (Competence) Modify the existing software if required by the statistic model, or create new software, if necessary.
4. KM12 (Knowledge) Provide the experimental hypotheses of modelling, considering the technical and ethical implications involved.
5. KM12 (Knowledge) Provide the experimental hypotheses of modelling, considering the technical and ethical implications involved.
6. KM13 (Knowledge) Detect interactions, co-linearity and importance between explanatory variables.
7. SM12 (Skill) Interpret the results obtained to formulate conclusions about the experimental hypotheses.
8. SM13 (Skill) Compare the degree of adjustment between diverse statistical models.
9. 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	

There will be theoretical sessions where the concepts related to the design of studies and experiments will be exposed.

These sessions will be complemented by practical sessions in a computer room where dedistance will be done with Statistical software.

All the above concepts will be applied through a work that can be done in a group.

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	55	15	0.6	KM12, KM13, SM12, SM13
Practical Sessions	15	15	0.6	CM09, KM12, KM13, SM12, SM13, SM14
Report	30	15	0.6	CM09, CM10, KM12, KM13, SM12, SM13, SM14

Continuous evaluation:

Report 40%(Minimum grade 4)
Practices 15%
Partial Exam 45% (Minimum grade 4)

Reassessed:

Maximum between:

100% final exam
Report 40% + Exam 60% (Minimum grade 4)

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 sciences. 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

Language list

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