Degree competences to which the subject contributes

Specific:
3. CE-1. Ability to design and manage the collection of information and coding, handling, storing and processing it.
4. CE-3. Ability to formulate, analyze and validate models applicable to practical problems. Ability to select the method and / or statistical or operations research technique more appropriate to apply this model to the situation or problem.
5. CE-4. Ability to use different inference procedures to answer questions, identifying the properties of different estimation methods and their advantages and disadvantages, tailored to a specific situation and a specific context.
6. CE-6. Ability to use appropriate software to perform the necessary calculations in solving a problem.
7. CE-7. Ability to understand statistical and operations research papers of an advanced level. Know the research procedures for both the production of new knowledge and its transmission.
8. CE-8. Ability to discuss the validity, scope and relevance of these solutions and be able to present and defend their conclusions.

Transversal:
Longitudinal data combine information from the variability between individuals and the evolution and variation within individuals. For this reason, they represent, by their frequency and relevance, a challenge not only for the professional statistician but also for the theoretical development.

The course objective is, first, to develop the theoretical framework and, second, to implement the knowledge gained by using the statistical software R.

### Teaching methodology

The course is practical and PBL oriented (Project / Problems Based Learning).

Specifically:

a) Outline the methodological needs from real data analysis,

b) Develop the theoretical model (interest will be focused on the modeling and interpretation of results and, secondarily, in demonstrating the theoretical results).

c) Return to the data to perform the analysis and interpretation of results.

Labs sessions will be in R.

### Learning objectives of the subject

Longitudinal data combine information from the variability between individuals and the evolution and variation within individuals. For this reason, they represent, by their frequency and relevance, a challenge not only for the professional statistician but also for the theoretical development.

The course objective is, first, to develop the theoretical framework and, second, to implement the knowledge gained by using the statistical software R.

### Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 125h</td>
<td>30h</td>
<td>0h</td>
<td>15h</td>
<td>0h</td>
<td>80h</td>
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</tr>
<tr>
<td></td>
<td>24.00%</td>
<td>0.00%</td>
<td>12.00%</td>
<td>0.00%</td>
<td>64.00%</td>
</tr>
</tbody>
</table>

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## Content

<table>
<thead>
<tr>
<th>Model</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear Mixed Model (LMM).</strong></td>
<td>36h</td>
<td><strong>Description:</strong> Linear Mixed Model (LMM).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theory classes: 7h 30m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laboratory classes: 4h 30m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self study : 24h</td>
</tr>
<tr>
<td><strong>Generalized Estimation Equations (GEE).</strong></td>
<td>25h</td>
<td><strong>Description:</strong> Generalized Estimation Equations (GEE).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td></td>
<td>Laboratory classes: 3h</td>
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<tr>
<td></td>
<td></td>
<td>Self study : 16h</td>
</tr>
<tr>
<td><strong>Longitudinal Data Analysis with multivariate response.</strong></td>
<td>12h 30m</td>
<td><strong>Description:</strong> Longitudinal Data Analysis with multivariate response.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theory classes: 4h 30m</td>
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<tr>
<td></td>
<td></td>
<td>Laboratory classes: 0h</td>
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<tr>
<td></td>
<td></td>
<td>Self study : 8h</td>
</tr>
<tr>
<td><strong>Generalized Linear Mixed Model (GLMM).</strong></td>
<td>25h</td>
<td><strong>Description:</strong> Generalized Linear Mixed Model (GLMM).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laboratory classes: 3h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self study : 16h</td>
</tr>
</tbody>
</table>
Introduction to Missing Data Analysis.

**Learning time:** 26h 30m
- Theory classes: 6h
- Laboratory classes: 4h 30m
- Self study: 16h

**Description:**
Introduction to Missing Data Analysis.

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Qualification system

- 20%: Homework to be done during the semester (report, presentation and defense). Task in group of 2-3 students.
- 10%: Report on a paper. Individual task delivered to the professor.
- 10%: Quiz in the Campus Digital (Atenea). Single answer multiple choice test and with penalization.
- 60%: Final exam (Theory -development questions and modeling problems: 30%, Laboratory - data analysis: 30%)

Regulations for carrying out activities

a) In the assessment of the Homework a 10% of self-assessment and peer assessment of the various groups will be taken into account.
b) Language for the Homework and the Report on a paper is English.
c) Final exam:
   c1) In this first part of the exam (theory and modeling questions) the student can NOT have the course material, but only writing instruments and calculator.
   c2) In the laboratory part the student may have all the course material (in paper and/or digital).
Bibliography

Basic:


Complementary: