

Unidade Curricular: Complements of Statistics for Engineering

Área Científica: MAT/CE

Duração: Semestral

Horas de trabalho: 162

Horas de contacto: 45

ECTS: 6 (3 MAT/ 3 CE)

Docente Responsável: Célia Maria da Silva Fernandes

Learning outcomes of the curricular unit

The objectives of this course are: (i) to provide students with fundamental concepts of statistics, which enables the handling of data related to scientific research on an experimental basis, (ii) to develop the ability to use statistical software that enables the application of statistical methods addressed in the curricular unit.

Syllabus

Exploratory data analysis (data exploration in order to understand its structure and the underlying variables and decide how they can be investigated with more formal statistical methods: graphical methods and univariate non-graphical, graphical methods and multivariate non-graphic). Parametric statistical inference (hypothesis tests about (a) parameter(s) of one or more populations). Nonparametric statistical inference (hypothesis tests about (a) parameter(s) of one or more populations when the conditions of applicability of parametric tests are not satisfied). Multiple Linear Regression Models (estimation of its parameters, hypothesis testing on their parameters, criteria for selection of variables). Multivariate statistical analysis (discriminant analysis, principal component analysis and cluster analysis).

Demonstration of the syllabus coherence with the curricular unit's learning objectives.

The topics of the syllabus, covering the fundamentals necessary for the student to acquire basic concepts of exploratory data analysis, parametric and nonparametric statistical inference, methods of multivariate data analysis, linear regression models and, the use of a statistical software, enables the student the handling of data related to scientific research on an experimental basis, fulfill the objectives (i) and (ii).

Teaching methodologies (including evaluation)

Classes operate on a theoretical-practical format in order the practical component is always present. Expository methodology is used for the presentation of theoretical subjects, using specific engineering related exercises. After the theoretical exposition are proposed activities for students solve and using the statistical software R. The assessment comprises two parts: 1) a Working Group with oral presentation, corresponding to 40% of the final grade; and 2) a Writing Assessment, corresponding to 60% of the final grade. The Writing Assessment may be performed by two alternative methods: two Tests or an Exam. To obtain approval from the UC the student needs to obtain a score of at least 8 in each of the two components of assessment (Working Group and Writing Assessment) and a final mark of not less than 10. For the Writing Assessment, if the student chooses the realization of two Tests, the final grade of the writing assessment is the arithmetic average of the scores of the two Tests.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The methodology aims to provide students with the basic knowledge of statistics and to provide students with the skills for the data analysis and the use of statistical software, enabling the student to undertake the analysis of data related to their future research activities.

Mandatory consultation/existence bibliography:

Everitt, B. Hothorn, T., An Introduction to Applied Multivariate Analysis with R, Springer,2011
Harrell, F., Regression Modeling Strategies: With Applications to Linear Models, Logistic Regression and Survival Analysis, Springer-Verlag,2001
Hollander, M., Wolfe, D., Nonparametric Statistical Methods, John Wiley & Sons,1999
Montgomery, D., Runger, G., Applied Statistics and Probability for Engineers, Wiley,2010
Pestana, D., Velosa, S., Introdução à Probabilidade e à Estatística – vol. I, Fundação Calouste Gulbenkian,2010
Reis, E., Melo, P., Andrade, R., Calapez, T., Estatística Aplicada – vol. I, Edições Sílabo,2007
Reis, E., Melo, P., Andrade, R., Calapez, T., Estatística Aplicada – vol. II, Edições Sílabo,2005
Reis, E., Estatística Multivariada Aplicada, Edições Sílabo,2001
Rencher, A., Christensen, W., Methods of Multivariate Analysis, Wiley,2012
Venables, W., Smith, D., the R Core Team. An Introduction to R. (<http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>), 2019