

## Syllabus

### Course description

<b>Course title</b>	Advanced Statistics
<b>Course code</b>	46001
<b>Scientific sector</b>	SECS/S-02
<b>Degree</b>	PhD in Sustainable Energy and Technologies PhD in Mountain Environment and Agriculture PhD in Food Engineering and Biotechnology PhD in Advanced-Systems Engineering
<b>Semester</b>	1
<b>Year</b>	1
<b>Academic year</b>	2019/2020
<b>Credits</b>	3
<b>Modular</b>	No

<b>Total lecturing hours</b>	20
<b>Total exercise hours</b>	-
<b>Attendance</b>	Yes
<b>Prerequisites</b>	Basic knowledge of probability and statistics
<b>Course page</b>	

<b>Specific educational objectives</b>	<p>The course is designed for acquiring professional skills and knowledge in the area of statistics.</p> <p>The students will be enabled to independent treatment of statistical research issues. Data analysis of typical research problems will be done in R.</p>
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<b>Lecturer</b>	Gianni Arioli
<b>Scientific sector of the lecturer</b>	MAT/05
<b>Teaching language</b>	English
<b>Office hours</b>	See Cockpit
<b>Teaching assistant (if any)</b>	-
<b>Office hours</b>	-
<b>List of topics covered</b>	<p>Review of basic statistical concepts</p> <p>Descriptive statistics</p> <p>Distributions</p> <p>Graphical representation of data</p> <p>Contingency tables</p> <p>Hypothesis testing</p> <p>Analysis of variance including interaction</p> <p>Linear and multilinear regression</p> <p>Logistic regression</p> <p>Linear and quadratic discriminant analysis</p>

	<p>Cross-validation. Bootstrap.</p> <p>Linear model selection: subset selection, shrinkage, principal component regression and partial least squares</p> <p>Principal component analysis, clustering</p>
<b>Teaching format</b>	Frontal lectures

<b>Learning outcomes</b>	<p>Knowledge and understanding Knowledge of the most important statistical methods for data analysis; understanding their rationale, conditions of usage and their results.</p> <p>Applying knowledge and understanding Identification of appropriate statistical method for data analysis; independent identification and application of functions in statistical package R.</p> <p>Making judgements Critical reviewing of own scientific work and of original publications; interpretation of statistical analyses in the context of diverse scientific fields.</p> <p>Communication skills Ability to present results of statistical analyses correctly and intelligibly.</p> <p>Learning skills Ability to recognize situations in which statistical analysis is necessary. Ability to judge the appropriateness of statistical methods.</p>
<b>Assessment</b>	Collaboration in exercises, presentation of a specific topic
<b>Assessment language</b>	English
<b>Evaluation criteria and criteria for awarding marks</b>	

<b>Required readings</b>	Teacher's slides in the electronic reserve collection.
<b>Supplementary readings</b>	<p>Ross, Sheldon M., Introduction to probability and statistics for engineers and scientists, 3<sup>rd</sup> ed., Amsterdam et al.: Elsevier Academic Press</p> <p>James, Witten, Hastie, Tibshirani. An Introduction to Statistical Learning with Applications in R, Springer 2013, freely available at <a href="http://www-bcf.usc.edu/~gareth/ISL/index.html">http://www-bcf.usc.edu/~gareth/ISL/index.html</a></p>