General Information	
Academic subject	Advanced data analysis methods for sustainable agronomic and environmental management
Degree course	International Master Degree Course in INNOVATION DEVELOPMENT IN AGRIFOOD SYSTEMS (IDEAS) - LM69
ECTS credits	6 ECTS
Compulsory attendance	No
Language	English

Subject teacher	Name Surname	Mail address	SSD
	Anna Maria STELLACCI	annamaria.stellacci@uniba.it	AGR/02

ECTS credits details	Area	SSD	Credits
Basic teaching activities	Disciplines of Production	AGR/02	6

Class schedule	
Period	Second semester
Year	First year
Type of class	Lectures, 4 ECTS (32 hours) Exercises on statistical procedures studied, study case analysis, seminars and lessons from experts in the studied disciplines, 2 ECTS (28 hours)

Time management	
Hours	150
In-class study hours	60 (32 Lectures + 28 exercises and case study analysis)
Out-of-class study hours	90

Academic calendar	
Class begins	2021 March 1
Class ends	2021 June 11

Syllabus	
Prerequisites/requirements	
Expected learning outcomes	• *Knowledge and understanding* ○ Knowledge of the principles of planning and analysis of traditional and innovative experimental designs for agronomic research and environmental monitoring. Basic knowledge of the principles of advanced data analysis methods studied, such as analysis of covariance and statistical methods for the analysis of repeated measures data in time and space. ○ Correctly understanding and interpreting data analysis results. Understanding, through the use of case studies analysis approach, the meaning and the importance of complex data analysis methods to improve the management of agronomic techniques and environmental sustainability. • *Applying knowledge and understanding* ○ Ability to plan experimental designs for research in

	agriculture; ability to apply the methodologies studied; ability to understand results of more complex data analyses techniques. • *Making informed judgements and choices* ○ Ability to select the most appropriate methodologies for planning an experimental design, analysing the data collected and understanding results obtained. • *Communicating knowledge and understanding* ○ Ability to present the results of the research activity; ○ Ability to transfer the theoretical and applied knowledge acquired from the scientific world to the agrifood sector. • *Capacities to continue learning* ○ Ability to further deepen advanced techniques for data analysis (analysis of spatial and temporal data; multivariate analysis; planning of more complex hierarchical designs).
Contents	Students will acquire basic theoretical and applied knowledge with regard to: •planning and analysis of traditional and innovative experimental designs for agronomic research and environmental monitoring; •main univariate and bivariate non-parametric analysis techniques; •analysis of covariance; •basic knowledge on assessment of temporal and spatial variability of observations and residual. In addition, through the analysis of case studies, the students will understand the meaning and the importance of complex data analysis methods to improve the management of agronomic techniques, experimental designs and environmental sustainability. Contents: Recall of traditional methods of data analysis (test of hypothesis, main parametric methods for univariate and bivariate analysis - analysis of variance, linear correlation and regression). Basic understanding of main univariate and bivariate non-parametric analysis techniques. Planning and analysis of traditional and innovative experimental designs for one-factor and factorial experiments. in non-hierarchical and hierarchical schemes. Analysis of covariance and use of auxiliary information, deriving also from proximal sensors, to improve the estimation of soil and crop variables. Basic understanding of statistical methods for the analysis of repeated measures data in time and space (different approaches, modeling the covariance structure of the residuals). Linear mixed effects models taking into account temporal and spatial correlation of soil and crop properties. Analysis and discussion of case studies will focus on: analysis of long-term field experiments (LTEs) data; identification of management zones (MZ) for agro-environmental applications (precision application of water and nutrient inputs); collection and analysis of proximal sensing information to estimate soil (TOC, SWC) and crop properties.

Course program	
Bibliography and reference books	Lecture notes and teaching material made available during the course. Littell R.C., Milliken G.A., Stroup W.W., Wolfinger R.D., Schabenberger O., 2006. SAS for Mixed Models, Second Edition. Cary, NC: SAS Institute Inc. Gomez K.A., Gomez A.A., 1984. Statistical procedures in agricultural research. New York, Chichester, etc.: Wiley, 2nd edition. France J., Thornley J.H.M., 1984 - Mathematical Models in agriculture. Butterworths, London. Camussi et al. - Metodi Statistici Per la Sperimentazione Biologica. Zanichelli Bologna. Further material will be provided on request by the teacher.
Notes	
Teaching methods	Lectures will be presented through Power Point, blackboard and documents prepared by the teacher. Exercises on data analysis will be performed also by means of statistical softwares (such as SAS and R).
Assessment methods	The final exam consists of an oral test with questions related to the lectures, exercises and laboratory classes. The intermediary exam consists of a written test. The expected learning outcomes, in terms of knowledge and skills, are listed in Annex A of the Master Degree Course Regulation (expressed through the European Descriptors of Degree qualification).
Evaluation	• *Knowledge and understanding* ○ Ability to plan appropriate traditional or innovative experimental designs; Ability to understand and use the main methodologies studied for data analysis (analysis of covariance; statistical methods for the analysis of repeated measures data). • *Applying knowledge and understanding* ○ Ability to apply the acquired knowledge to solve case studies. • *Making informed judgements and choices* ○ Ability to select the most appropriate methodologies and correctly interpret the results of statistics tests studied. • *Communicating knowledge and understanding* ○ Ability to present the results of the research activity. • *Communication skills* ○ Ability to organize the acquired knowledge in form of didactic presentation and to articulate it for didactic purposes. ○ Ability to transfer the theoretical and applied knowledge acquired from the scientific world to the agrifood sector. • *Capacities to continue learning* ○ Ability to further deepen advanced techniques for data analysis (analysis of spatial and temporal data; multivariate analysis; planning of more complex hierarchical designs).
Further information and receiving times	Every day (monday - friday) on appointment to be arranged in

	advance by e-mail. Tutoring could take place also on e-learning platforms.