General information	
Academic subject	***Statistical procedures for agricultural research and agrometeorology***
Degree course	Master degree in Plant Medicine (LM69)
Academic Year	2021-2022 (First year – first semester)
European Credit Transfer and Accumulation System (ECTS)	6
Language	Italian (English will be used when required for foreign students and into didactic material)
Academic calendar (starting and ending date)	September 27th 2021-Junuary 21st 2022 (Pause 2021 November 22nd – December 3rd, for midterm exam)
Attendance	Recommended but not compulsory

Professor/ Lecturer	
Name and Surname	**Anna Maria Stellacci**
E-mail	annamaria.stellacci@uniba.it
Telephone	
Department and address	Dipartimento di Scienze del Suolo della Pianta e degli Alimenti (DiSSPA) Università degli Studi di Bari Aldo Moro Via Amendola 165/A, 70126 Bari (Italy)
Virtual headquarters	TEAMS platform: annamaria.stellacci@uniba.it
Tutoring (time and day)	Tutoring will take place during official visiting days and hours (Monday-Friday; 8.30-13.30), according to appointments to be arranged in advance by e-mail. Tutoring could also take place on e-learning platforms (Teams).

Syllabus	
Learning Objectives	Provide knowledge and understanding on: • principles of experimental design and planning; main parametric methods for univariate and bivariate analysis; • theoretical and practical aspects of agrometeorology and agricultural modelling.
Course prerequisites	Prerequisites for the access to the Master degree.
Contents	• Statistics in agricultural research. Population and samples, parameters and statistics. Frequency distributions. • Descriptive statistics. Measures of central tendency and location: mean, median, mode. Measures of variability: sum of squares (SS), mean square (MS), standard deviation, coefficient of variation, standard error of the mean. Measures of shape: skewness and kurtosis. • Probability distributions. Normal distribution, standard normal distribution. Hypothesis testing. • Comparison of two population means. Independent samples and paired samples. Student t test. • Experiment planning. Elements of experimentation. Experimental unit, experimental error, replication and randomization, experimental design. • Analysis of variance. Experimental designs: completely randomized design (CRD), randomized complete block design (RCBD), latin square design, split-plot and strip plot (split-block) designs. • Comparison between treatment means; post-hoc tests for mean comparison. • Analysis of the relationships between two series of data. Linear regression and correlation analysis. • Definitions of meteorology, agrometeorology, climatology and

	agroclimatology. • Agrometeorological parameters. Solar radiation, radiation parameters and laws (Planck, Wien, Stefan-Boltzmann). Energy balance. Methods and units of measures. Eliophany. Effects on crops. • Temperature and heat. Temperature parameters. Thermal sum. Air temperature. Soil temperature. Effects on crops. Measure instruments. Temperature and agronomical techniques. • Relative air humidity. Definitions and general aspects. Dew-point temperature. Effects on the crops. Measure instruments. • Precipitations. Definitions and general aspects. Precipitation characteristics: amount, distribution, frequency, intensity, duration. Measure of the rainfall. Probability of rainfall. Importance of the rainfall for agriculture crops. • Wind. Intensity and direction. Measure of wind speed. Effects on crops. Wind erosion. • Evaporation and evapotranspiration. Definition and general aspects. Methods of measure and estimate of reference evapotranspiration (ETo) and maximum crop evapotranspiration (ETc). Empirical equations and micro-climatic methods. • Mathematical models. Definitions, classification and general aspects. Choice and application of models. Calibration, validation and analysis of sensitivity • Applications of agrometeorology.
Books and bibliography	Notes of the lectures and teaching material distributed during the course. • Camussi et al., 1995. Metodi statistici per la sperimentazione biologica. Zanichelli Bologna. • Gomez K.A., Gomez A.A., 1984. Statistical procedures in agricultural research. New York, Chichester, etc.: Wiley, 2nd edition. • Ceccon P., Borin M., 1995 - Elementi di agrometeorologia e agroclimatologia. Imprimitur.
Additional materials	Additional readings • Quinn G.P., Keough M.J., 2002. Experimental Design and Data Analysis for Biologists. Cambridge. • France J., Thornley J.H.M., 1984 - Mathematical Models in agriculture. Butterworths, London. • Benincasa F., Maracchi G., Rossi P., 1991 – Agrometeorologia. Patron, Bologna. • Scientific papers provided by the teacher. Further material will be provided by the teacher on request.

Work schedule			
Total	Lectures	Hands on (on-class exercises, seminars by experts in the studied disciplines, working groups)	Out-of-class study hours/ Self-study hours
Hours			
60	32	28	90
ECTS			
6	4	2	
Teaching strategy	Learning activities will consist in theoretical lectures and applied activities including exercises on statistical procedures studied, study case analysis, seminars and lessons from experts in the studied disciplines. Oral lessons will be supported by Power Point presentations, the use of the		

	blackboard and by documents prepared by the teacher. Exercises on data analysis will be performed also by means of statistical softwares (such as SAS and R). E-learning through public platforms (e.g. Teams) can be used, on demand. experts in the studied disciplines
Expected learning outcomes	
Knowledge and understanding on:	• Knowledge on the principles at the basis of an experimental design; knowledge on the main parametric methods for univariate and bivariate analysis (analysis of variance for the main experimental designs used in agriculture for one factor or more than one factor (factorial experiments); comparison between two samples; correlation and linear regression); • Knowledge on theoretical and practical aspects of agrometeorology and on the principles of modelling and models for crop diseases.
Applying knowledge and understanding on:	• Ability to plan an experimental design for research in agriculture; Ability to apply basic techniques for univariate and bivariate parametric analysis; • Ability to understand the relationships among environment and agriculture.
Soft skills	• *Making informed judgments and choices* o Ability to correctly interpret the results of basic statistics tests for the assessment of the effects of one-factor or factorial experiments; o Critic evaluation of the topics related to the climatic variability, and the current and predictable climatic effects on the environment and agriculture through mathematical models. • *Communicating knowledge and understanding* o Ability to present the results of the research activity; o Ability to synthetize the results of the interaction among climatic variables, plants, pest and disease. • *Capacities to continue learning* o Ability to further deepen advanced techniques for data analysis (hierarchical designs with more than two factors; multivariate analysis; analysis of covariance) and models for the management of plant-pathogen interaction. Expected learning outcomes, as knowledge and ability, are reported in the annex A of the Didactic Regulation of the course in Plant Medicine (expressed by European Descriptors).

Assessment and feedback	
Methods of assessment	The final exam consists of an oral test with questions related to the lectures, exercises and laboratory classes. An intermediary written exam will be also performed, including three exercises [Student t test for unpaired data; regression and correlation analysis; one-factor analysis of variance for a latin square design].
Evaluation criteria	• *Knowledge and understanding* o The student is able to plan an experimental design for agricultural research; o The student is able to use the main parametric univariate and bivariate methods of data analysis (analysis of variance for the main experimental designs used in agriculture for one factor or factorial experiments; comparison between two sample means; bivariate analysis: correlation and linear regression); o The student knows the main theoretical and practical aspects of agrometeorology and principles of mathematical modelling in agriculture. • *Applying knowledge and understanding*

	o Ability to plan an experimental design for agricultural research; o Ability to apply basic parametric analysis techniques for univariate and bivariate datasets; o Ability to study the relationships among environment and agriculture. • *Making informed judgements and choices* o Ability to correctly interpret the results of basic statistics tests for the assessment of the effect of one-factor or factorial experiments. o Critic evaluation of the topics related to the climatic variability, and the current and predictable climatic effects on the environment and agriculture through mathematical models. • *Communicating knowledge and understanding* o Ability to present the results of the research activities. o Ability to synthetize the results of the interaction among climatic variables, plants, pest and disease. • *Communication skills* o ability to organize the acquired knowledge in form of didactic presentation. • *Capacities to continue learning* o Ability to further deepen and understand advanced techniques for data analysis (hierarchical design with more than two factors; multivariate analysis; analysis of covariance) and models for the management of plant-pathogen interaction.
Criteria for assessment and attribution of the final mark	The evaluation of the student is based on criteria previously fixed such as those reported in the Annex A of the Didactic Regulation of the Master Course in Plant Medicine and is expressed in thirtieths. The final score is within 18/30 to 30/30. The exam is considered passed if a final score of at least 18/30 is reached.
Additional information	