General Information	
Academic subject	**Statistical procedures for agricultural research and agrometeorology**
Degree course	**Master's degree in Plant Medicine (LM69)**
Curriculum	
ECTS credits	6
Compulsory attendance	No
Language	Italian (English will be used when required for foreign students into didactic material)

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	First semester
Year	First year
Type of class	Lectures, 4 ECTS (32 hours) Exercises on statistical procedures studied, laboratory and field classroom, study case analysis, seminars and lessons from experts in the studied disciplines, 2 ECTS (28 hours) E-learning through public (e.g. Teams) platforms can be used, on demand, as learning facilities for students with disabilities and for working students, student athletes and students with babies.

Time management	
Hours	150
In-class study hours	60 (32 Lectures + 28 Lab & field cl.)
Out-of-class study hours	90

Academic calendar	
Class begins	September 28, 2020
Class ends	January 22, 2021

Syllabus	
Prerequisites/requirements	
Expected learning outcomes	• *Knowledge and understanding* o Knowledge of the principles at the basis of an experimental design; knowledge of 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 regression); o Knowledge of theoretical and practical aspects of agrometeorology and of the principles of modelling and models for crop diseases. • *Applying knowledge and understanding*

	○ Ability to plan an experimental design for research in agriculture; Ability to apply basic techniques for univariate (comparison between two sample means; analysis of variance) and bivariate (regression and correlation) parametric analysis; ○ Ability to understand the relationships among environment and agriculture. • *Making informed judgements and choices* ○ Ability to correctly interpret the results of basis statistics tests for the assessment of the effects of one-factor or factorial experiments; ○ 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* ○ Ability to present the results of the research activity; ○ Ability to synthetize the results of the interaction among climatic variables, plants, pest and disease. • *Capacities to continue learning* ○ Ability to further deepen advanced techniques for data analysis (hierarchical designs with more than two factors; multivariate analysis) 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 Plant Medicine (expressed by European Descriptors).
Contents	• Statistics in agricultural research. Population and samples, parameters and statistics. Frequency distributions. • Descriptive statistics. Measures of central tendency and location: mean, mode, median. 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, agro-meteorology, climatology and agro-climatology.

	• Agro-meteorological 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 the ET. Weighing lisymeters, empirical equations and micro-climatic methods. • Mathematical models. Definitions, classification and general aspects. Mechanicistic and stochastic models. Choice and application of models. Calibration, validation and analysis of sensitivity. • Applications of agrometeorology.
Course program	
Bibliography	Notes of the lectures and teaching material distributed during the course. Camussi et al. - Metodi Statistici Per la Sperimentazione Biologica. Zanichelli Bologna. Ceccon P., Borin M., 1995 - Elementi di agrometeorologia e agroclimatologia. Imprimitur. Benincasa F., Maracchi G., Rossi P., 1991 – Agrometeorologia. Patron, Bologna. Additional readings 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. Further material will be provided on request by the teacher.
Notes	
Teaching methods	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 software (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, whereas the intermediary exam consists of a written test, including three exercises [Student t test for unpaired data; regression and correlation analysis; one-factor analysis of variance for a latin square design], such as reported in the Didactic Regulation in Plant Medicine (art.9) and in the syllabus (annex A). The evaluation of the student is based on criteria previously fixed such as reported in the Annex A of the Didactic Regulation of the Master Course in Plant

	Medicine and is expressed in thirtieths.
Evaluation	• *Knowledge and understanding* o The student is able to plan an experimental design; 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 modelling and models for crop diseases. • *Applying knowledge and understanding* o Ability to plan an experimental design; 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 basis 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 activity; 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 and to articulate it for didactic purposes • *Capacities to continue learning* o Ability to further deepen advanced techniques for data analysis (hierarchical design with more than two factors; multivariate analysis; covariance analysis) and models for the management of plant-pathogen interaction.
Further information	**Visiting hours** Tutoring will take place during official visiting hours (8.30-13.30), according to an established appointment requested by phone or e-mail. Tutoring could be also on e-learning platforms.