UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali
ACADEMIC YEAR	2022/2023
BACHELOR'S DEGREE (BSC)	PROPAGATION AND NURSERY MANAGEMENT IN THE MEDITERRANEAN ENVIRONMENT
SUBJECT	PRINCIPLES OF GENETICS AND GENETIC IMPROVEMENT
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	70242-Formazione agro-biologica di base
CODE	21716
SCIENTIFIC SECTOR(S)	AGR/07
HEAD PROFESSOR(S)	GIAMBALVO DARIO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	4
INDIVIDUAL STUDY (Hrs)	60
COURSE ACTIVITY (Hrs)	40
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**GIAMBALVO DARIO** Monday 08:30 13:30 Stanza docente (Edificio 4, ingresso L, secondo piano)

DOCENTE: Prof. DARIO GIAMBALVO

PREREQUISITES	Basics of applied botany, general and organic chemistry.
LEARNING OUTCOMES	Knowledge and understanding. At the end of the course, the student will acquire the theoretical and experimental basic knowledge of classical and modern genetics on: structure and function of hereditary material (DNA, genes, chromosomes and genomes), replication, flow of genetic information (from DNA to proteins), general information on mutations, cell cycle, mitosis and meiosis; Mendelian genetics, exceptions to Mendelian genetics, differences between monogenic and polygenic traits, genetic variability as the basis of genetic improvement (mutations, crossing, recombination), sexual hybridization: emasculation, cross-pollination and self-fertilization, sexual barriers between species, self-incompatibility, hints on the genetic improvement of autogamous and allogamous species, through the presentation of simple case studies. Ability to apply knowledge and understanding. Ability to define the basic principles of Mendelian genetics; understand the genetic control of monogenic and polygenic traits; understand the influence of the environment on the expression of plant traits; have the necessary tools to understand traditional and innovative plant breeding techniques. Autonomy of judgment. Ability to use the knowledge acquired to be able to express judgments on the genetic control of important plant traits, on the influence of the environment on their expression and to suggest traditional and innovative approaches for the improvement of crops. Communication skills. The student must be able to use a technically correct and simple language to explain the basic notions of genetics and plant breeding; he/she must also be able to relate to specialized technical figures in the nursery and seed sector. Learning skills. At the end of the course, the student must have acquired the ability to independently deepen the topics covered in the course, being able to carry out an autonomous update through the consultation of technical and scientific publications and to easily follow both master's courses or higher level courses, as well as specialized seminars on issues relating to Mendelian, quantitative and population genetics and plant breeding.
ASSESSMENT METHODS	The learning will be assessed through an oral examination. In this exam the students will have to answer questions about the topics of the course, and they have to show an adequate knowledge, acquisition of interpretative skills, capacity of connecting and processing the arguments, as well as a relevant presentation capacity. The final grade will be expressed in thirtieth and will be judged insufficient when the student will demonstrate: difficulty to focus on the proposed topics, a shallow knowledge of the arguments and extreme limited exposure ability. The sufficiency threshold (18/30) will be reached when the student will show knowledge and understanding of the topics at least in general lines and have minimal applicative skills in order to solve application cases; he must equally possess exhibition skills and language properties appropriate to the type of teaching. As the degree of details of the proven knowledge increase will proportionally increase the positivity of the grade. The maximum score (30/30)will be obtained in case of excellent mastery and critical-interpretative jurisdiction of the subject content of the course and a good exposition proved by the use of proper scientific terminology.
EDUCATIONAL OBJECTIVES	The course is structured in order to provide the basic notions on: organization and transmission of hereditary material, Mendelian genetics, controlled crossing techniques, traditional and innovative plant breeding techniques. The notions of the course will allow the student to understand: the main mechanisms underlying the inheritance of characters, gene interactions, the importance of genetic variability in the context of plant breeding, the relationships between reproductive systems and methods of plant breeding.
TEACHING METHODS	The course will consist of: - lessons, with interactive student involvement; - exercises on Mendelian genetics and some examples of exceptions to Mendelian genetics; simple selection schemes. Seminars on: - Traditional and innovative genetic improvement techniques.
SUGGESTED BIBLIOGRAPHY	Lorenzetti et. al (2011). Genetica Agraria. Patron editore. ISBN 9788855531238 Russell et al. (2016). Genetica Agraria. Edizione integrata a cura di Busconi M., Comino C., Consonni G., Marocco A., Porceddu A., Portis E., Rao R. - EdiSES. ISBN 8879598937 Materials provided by the teacher

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the course: objectives, organization of the lessons and of the final examination, connections with the other courses of the Bachelor's Degree.
5	Constitutive elements and structure of nucleic acids (DNA and RNA). DNA replication. The gene: structure e functions. The genetic code. Types of RNA. Protein synthesis.
2	Structure and morphology of the chromosome; mitosis and meiosis.
2	Gene, chromosomal, genomic mutations.
5	Mendelian principles and chromosomal theory of inheritance. Mendel's laws: dominance and recessivity, independent segregation. Gene interactions and examples of exceptions to Mendelian genetics: codominance, epistasis; pleiotropy. Outline of the chi-squared test.
3	Gene association. Recombination of associated genes: crossing-over. Basic of genetic maps. Differences between monogenic (qualitative) and polygenic characters. Genotype, environment, phenotype. Hereditability
4	Hermaphroditism, monoicism and dioicism. Sexual hybridization: cross-pollination and self-fertilization, reproductive barriers of cultivated plants (self-incompatibility). Species with asexual or vegetative or agamic propagation. The concept of clone. Sources of variability: genetic diversity and the concept of gene pool. Create or increase genetic variability (Inter and intraspecific hybridization - Mutagenesis - protoplast culture, somatic hybridization, GMO - and Genome editing).
6	Goals of plant breeding. Ideotype. Relations between reproductive systems and methods of plant breeding. Basic of plant breeding of autogamous and allogamous species, through the presentation of simple case studies. Molecular markers and marker assisted selection (MAS).

Hrs	Practice
10	Exercises on: Mendelian genetics, inheritance of quantitative traits, genetic structure of populations. Emasculation techniques, pollen collection, controlled crossing. Seminars on: - Traditional and innovative genetic improvement techniques.

Hrs	Workshops
2	DNA extraction, PCR, molecular markers, sequencing.