UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali
ACADEMIC YEAR	2019/2020
BACHELOR'S DEGREE (BSC)	AGRICULTURAL SCIENCES AND TECHNOLOGIES
SUBJECT	AGRICULTURAL GENETICS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50122-Discipline biologiche
CODE	11812
SCIENTIFIC SECTOR(S)	AGR/07
HEAD PROFESSOR(S)	GIAMBALVO DARIO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	7
INDIVIDUAL STUDY (Hrs)	115
COURSE ACTIVITY (Hrs)	60
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° 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	None.
LEARNING OUTCOMES	- Knowledge and understanding At the end of the course, the student must have acquired basic knowledge on the structure and function of nucleic acids, on the cell cycle, on mitosis and meiosis, on Mendelian, quantitative and population genetics. These tools, together with the knowledge on multiple genetic-molecular applications, will offer the student the opportunity to critically analyze the potential of genetics to protect and enhance plants of agricultural interest, use new technologies, guarantee the sustainability of productions and safeguard the environment. - Ability to apply knowledge and understanding The student will have to demonstrate to know and understand the problems related to genetics proving to be able to face even complex discussions concerning the hereditary material and the application of genetic techniques in agriculture. - Autonomy of judgment Ability to use the acquired knowledge to be able to express judgments on the genetic control of important characters, on the influence of the environment on their expression and to suggest traditional and innovative approaches for their improvement. - Communication skills The student will have to be able to use a technically correct but simple language to explain the basic notions of molecular and Mendelian genetics. - Learning ability At the end of the course, the student must have acquired the ability to study in depth the topics raised 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 courses and courses in-depth study, as well as specialized seminars on topics related to Mendelian, quantitative and population genetics.
ASSESSMENT METHODS	The exam will consist of two written tests (one in progress and one final) concerning the topics raised during the course. The tests will consist in a questionnaire (lasting 90-minutes) with multiple choice and open questions. The evaluation of the test will be expressed in thirtieths; each question will have a variable score depending on its difficulty (the maximum score assigned to each question will be indicated in the questionnaire); a minumun grade of 18 is needed to pass the test. The maximun total score (30/30) will have the possibilty to be awarded cum laude decided based on the clarity of the written report. The final mark out of thirty will be given by the evaluations obtained in the two tests. Students who fail to take or fail the written test must take an oral exam on the entire program of the two modules. The oral exam will consist in an interview aimed at verifying the knowledge and interpretative competence of the general and specific contents of the program, the ability to connect and elaborate the contents and the expository capacity. The evaluation of the test will be expressed in thirtieths and will be deemed insufficient in the event that the student demonstrates: difficulty in focusing on the proposed topics, incomplete knowledge of the topics and extreme limitation in the exposure. As the degree of detail of the knowledge demonstrated by the student increases, the positivity of the evaluation will increase proportionally. The maximum score will be obtained in the case of excellent mastery and critical-interpretative competence of the contents of the course, associated with good exhibition skills and the use of appropriate scientific terminology.
EDUCATIONAL OBJECTIVES	At the end of the course the student will have learned the notions related to the structure and function of nucleic acids, to the cell cycle, to mitosis and meiosis, to Mendelian, quantitative and population genetics. The concepts of the course will allow us to understand the mechanisms of character inheritance, gene interactions and regulation of gene expression. The course will also include practical exercises on qualitative and quantitative characteristics by applying statistical methods.
TEACHING METHODS	The course will consist of: - lectures, with interactive involvement of students for immediate feedback on their learning ability; - exercises including mendelian genetic exercises, associations, inheritance of quantitative traits, genetic structure of populations, Hardy-Weinberg equilibrium and its disturbance factors; - seminars on genetic engineering techniques and implications related to the use of genetically modified organisms.
SUGGESTED BIBLIOGRAPHY	Lorenzetti et. al (2011). Genetica Agraria. Patron editore. Barcaccia, Falcinelli (2008). Genetica e Genomica (Vol. I e II). Liguori editore.

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the course: educational objectives, organization of the lessons and of the final examination, connections with the other courses of the Bachelor's Degree.

SYLLABUS

Hrs	Frontal teaching
7	History of genetics: fundamental stages. Constitutive elements and structure of nucleic acids (DNA). DNA replication. Types of RNA: characteristics and functions. The gene: structure and functions. The genetic code. Transcription and translation: protein synthesis. Central dogma of molecular biology. Mechanisms of regulation of gene expression.
4	Organization and transmission of the hereditary material: the genome; chromosome structure and morphology; chromatin organization; non-nuclear genome components; mitosis and meiosis; cytoplasmic inheritance.
6	Mendelial principles. dominance; independent segregation, recombination; statistical analysis of segregation and independent assortment; multiple alleles; gene interactions and atypical segregation patterns: incomplete dominance, epistasia, lethal factors; pleitropia, penetrance and expressiveness.
4	Association (linkage): fundamental concepts. Exceptions from the independent assortment: Bateson's experiments. Recombination of associated genes: crossing-over. Calculation of map distances. Molecular markers
3	Modification of genetic material. Gene, chromosomal and genomic mutations. Polyploidy. Transposons.
2	Inheritance and sex. Monoicism and Dioicism. Gene and chromosomal determination of sex. Sex related characters.
4	Inheritance of quantitative characters. Influence of environmental factors on quantitative characters. Experiments by Johannsen, Nilsson_Ehle and by East (multifactorial hypothesis). The concepts of heritability in the broad sense and in the strict sense. Breakdown of genetic variance. Progress achievable with the selection.
7	Genetic structure of populations of mainly autogamous and mainly allogamous species. Hardy-Weinberg's law of genetic balance. Balance disturbance factors: mutations, gene flow, genetic drift, selection, inbreeding. Genetic theories on inbreeding depression and heterosis.
2	Outline of genetic engineering. Restriction enzymes. Exogenous DNA transfer vectors. DNA analysis by electrophoretic techniques. PCR and sequencing.

Hrs	Practice
18	Exercises on: Mendelian genetics, associations, inheritance of quantitative characteristics, heritability, genetic structure of populations, Hardy-Weinberg equilibrium and on disturbance factors. Laboratory practice.

Hrs	Others
2	Seminar on genetic engineering techniques and implications related to the use of genetically modified organisms