COURSE OF STUDY *Master degree: INNOVATION DEVELOPMENT IN AGRI-FOOD SYSTEMS (IDEAS) (LM69)*

ACADEMIC YEAR *2023-2024*

ACADEMIC SUBJECT *Modern Plant Breeding Strategies*

General information	
Year of the course	*First*
Academic calendar (starting and ending date)	*First semester (October 16th – January 26th, 2024)*
Credits (CFU/ETCS):	9
SSD	*Modern Plant Breeding Strategies (AGR/07)*
Language	*English*
Mode of attendance	*No Compulsory*

Professor/ Lecturer	
Name and Surname	Domenica Nigro
E-mail	domenica.nigro@uniba.it
Telephone	0805442997
Department and address	*DIP. DISSPA – Università degli Studi di Bari*
Virtual room	*Microsoft Teams: code 3o84dhy*
Office Hours (and modalities: e.g., by appointment, on line, etc.)	*Monday to Friday by appointment only.*

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
180	48	42	90
CFU/ETCS			
9	*6*	*3*	

Learning Objectives	The course aims to provide knowledge on the different breeding methods for crop improvement as well as molecular and genetics tools, with a specific focus on the most recent advanced available technologies.
Course prerequisites	Students must have a good basic knowledge of general and agricultural genetics, as well as of plant biological systems.

Teaching strategies	Lectures will be held with the help of PowerPoint presentations and videos. Lecture notes and educational supplies will be provided by e-mail or online platforms.
Expected learning outcomes in terms of	
Knowledge and understanding on:	Theoretical and practical basis of modern and new breeding strategies and their application to crops, especially indigenous genotypes adapted to low-input cultivation systems.

Applying knowledge and understanding on:	Apply advanced technologies for the design of new cultivars adapted to low-inputs management systems, more tolerant to biotic and abiotic stresses, and with improved nutritional characteristics.
Soft skills	• Making informed judgments and choices: Students will acquire the ability to critically interpret the advantages and disadvantages of the different illustrated methodologies. • Communicating knowledge and understanding: Students will acquire the ability to write and present experimental results in a clear and synthetic way. • Capacities to continue learning: Students will learn about modern plant breeding strategies and genetic biotechnology, how to qualify the different fields of application and apply them in the international productive context.
Syllabus	
Content knowledge	• Genetic resource utilization and conservation Challenges of modern plant breeding. Origin of plant domestication and breeding. Biodiversity and genetic erosion. Plant genetic resources. • Breeding strategies and Molecular breeding Overview of plant reproduction systems. Breeding strategies for autogamous, allogamous and vegetatively propagated species. Experimental mutagenesis: principles, means and results. Tilling technology and applications. Genotyping by sequencing; technology and applications. MAS: marker assisted selection, technology and applications. New genotyping systems. • New Plant breeding techniques GMOs: synthesis and construct delivery. Plants genetic transformation methods. Cisgenesis, Intragenesis and Transgenesis. Types of selectable marker genes. Marker-free plants (site-specific recombination, transposition, homologous recombination, clean gene). Genome editing: sequence-specific nuclease technology. Zinc Finger Nucleases (ZFNs), Meganucleases, TALENs and CRISPR/Cas9 Techologies. Examples of potential application of New plant breeding techniques. In vitro culture techniques. • Lab practices concerning the above reported topics.
Texts and readings	• Genetics and Plant Breeding, Roderick Wiley & Aiden Deleon, Scientific e-Resources, 2019, 1839472715, 9781839472718. • Advanced Molecular Plant Breeding: Meeting the Challenge of Food Security, D.N. Bharadwaj, CRC Press, 2018, ISBN: 1351358472, 9781351358477. • Lecture notes. • Bibliographic material: Scientific papers in international journals.
Notes, additional materials	• Advanced Molecular Plant Breeding: Meeting the Challenge of Food Security. Stati Uniti: Apple Academic Press, 2018. ISBN: 9781351358477, 1351358472.

	• Examples and case study discussions made in class.
Repository	All teaching material will be available to students on web platforms (class Teams code *3o84dhy*).

Assessment	
Assessment methods	The exam consists of an oral dissertation on the topics developed during the theoretical and theoretical-practical lectures in the classroom and in practical activities (laboratory and educational visits). Students may have a middle-term preliminary exam, consisting of an oral test, relative to the first part of the program, which will concur to the final evaluation and will be considered valid for one academic year (Art. 4 of the Didactic Regulations of the International Master's Degree Course in Innovation Development In Agri-Food Systems (IDEAS)). The result of the mid-term exam is communicated by publication in the student's electronic register and contributes to the assessment of the profit examination by means of calculation of the weighted average.
Assessment criteria	• Knowledge and understanding: ○ Students must demonstrate full knowledge of the examined genetic improvement methods and genetic and biotechnology tools. • Applying knowledge and understanding: ○ Students must demonstrate full mastery in identifying and applying the most appropriate genetic improvement methods and genetic biotechnologies, among those examined, to respond to different biotechnological questions. • Autonomy of judgment: ○ Students must demonstrate their ability to critically evaluate the limiting factors of each analysed experimental procedures. • Communicating knowledge and understanding: ○ Students must demonstrate clarity and completeness in the oral presentation of the program contents. • Communication skills: ○ Communicating the theoretical acquired concepts using the appropriate scientific language and the specific lexicon of genetics and biotechnologies. • Capacities to continue learning: ○ Capacity of communicate and continue learning the principal genetic methodologies for crop and food production as well as integrate and them to the contents of other courses.
Final exam and grading criteria	The assessment of the student's preparation is based on predetermined criteria in accordance with the Didactic Regulations of the International Master's Degree Course in Innovation Development In Agri-Food Systems (IDEAS) (art. 4). The Examination Committee has a score ranging from a minimum of 18 to a maximum of 30 points for a positive assessment of the student's performance. By unanimous vote of its members, the Board may award honours in cases where the final mark is 30.
Further information	