emPLANT

master to sucseed

COURSE CATALOGUE

LAS SEMESTER 1

emPLANT COURSE CATALOGUE

ERASMUS MUNDUS MASTER PROGRAMME IN PLANT BREEDING

Contents

Joint Courses

JOINT COURSES	Description, contents, learning outcomes	Prerequisites	Implementation:	ECTS
Pilot case	Semester 1 and 2: UniLaSalle, SLU Semester 3: UH, UPV, EgeU The pilot case is a case study to apply the project management tools to a breeding program. First students by group have to choose a species to be ameliorated. Then, find a character or several ones as goal for the breeding strategy. The students need to check the market potential for this new variety and verify that farmers will want to cultivate it. Secondly, students will define the potential market for their product (seeds), but also the market for the new variety (consumers). Thirdly, they need to create a structure to breed the new variety, and define the role of each student of the group in this structure (company, association...).	No prerequisites	The introduction to the Pilot Case will take place during the Joint Integration Week where the groups will be formed based on the specialty chosen by the students for Y2. During the first year the students will work in groups with their tutors and via telephone/video conference/email if group members are not located at the same site (LAS/SLU). During S3 the Pilot Case will be finalized with the tutors at the host university and by telephone/video conference/email among the group members. Two juries will be organized. The first jury at the end of S1 will evaluate the content and the form of the work and especially the project management content. At the end of S2 a written report will be evaluated. At the end of S3 a jury composed of the local tutors, the Coordinators for Y1 and an expert in Project Management will judge the defense of the Pilot Case. The students of S1 and S3 will be able to attend their respective presentations. The juries of S1 and S3 will be carried out on the same day for logistic reasons.	**S1: 3** **S2: 3** **S3: 2**

Semester 1 LAS

SEMESTER 1 LAS	Description, contents, learning outcomes	Prerequisite	ECTS
French as a foreign language	This language course aims at providing students with the necessary language tools to interact successfully in everyday life and in basic professional situations. After a 2 week intensive language course, students will continue to learn French at the rate of 3 hours per week. In addition to classroom instruction, students will realize interactive assignments, such as conducting surveys amongst their French peers. These assignments, are designed to familiarize students with cultural aspects in France and the French-speaking world. Introducing yourself and introducing someone else. Asking questions. Talking about your professional activities. Expressing preferences. Understanding an itinerary. Expressing an intention. Making appointments. Understanding a schedule.	No prerequisites	**2**
Spanish as a foreign language	This language course is targeted at students who chose UPV as Y2 destination and who still need to bring their Spanish to a B2 level for everyday life and professional situations. Students will learn Spanish at the rate of 2 hours per week. In addition to classroom instruction, students will realize interactive assignments. This course is carried out in close collaboration with UPV so as to ensure that the students obtain the language level needed.	B1	**2**
Interculturality & ethics	To raise awareness and develop skills around culture and its impact on behavior in international teams. Students will draw on their own experience of learning within a multi-cultural team immersed in a host culture. Reading - implementation of the method of ethics: analysis, explanation of the differentiated arguments of the ethical issue. Know how to comment - discern the positioning that appears to us most relevant and be able to account for it. Be able to justify and explain contradictory arguments. Program : 1) Culture: definitions, metaphors; key concepts. Culture as a source of intercultural errors. 2) Cross cultural communication : "Talk to me" 3) Managing an international team : “When in Rome . . . “ (case study; video) 4)Cultural perceptions of things: marketing, management, negotiation, hiring; 5) Student reports: results of expatriate manager interview 6) Student presentations of x-cultural training packages 7) Independent/group work on assignments and projects 8) Introduction - What is ethics? Distinction between ethics and ethics: stake, history, relevance. Ethics as a social or political dimension of morality which is personal: what is possible, desirable, and necessary in a given political, social, entrepreneurial body. 9) COMPOSITION and not RESOLUTIVE: composed of the Common Principles / Principles proper / Matter / circumstances / intention. From examples (flight to survive, revolution, tyrant ...) Explain the relative middle of the virtues and proportionality of the relations of justice / injustice.	No prerequisites	**1**
Introduction to seed business	Identify several factors going to impact the way of organizing companies on a regional and global scale such a long term activity as the breeding and the selection, in relation with transversal technologies and breeder’s profiles: technological traits,	No prerequisites	**4**

	biotechnologies, markets, climatic changes, natural resource limitations, exchanges between countries and continents. Researchers and managers from seed companies and from agri-food industries will share their view of current status and prospective future of breeding activities and targets. 15 lectures followed by discussion, prepared in advance by students from keywords. 1 seminar to introduce the Pilot Case module “design a breeding project” guidelines will be given to student to follow.		
Introduction to algorithmics	Objectives : - Know how to use the fundamental structures of the algorithmics - Know how to analyze a problem and solve it with an algorithm - To implement an algorithm - To use a procedural language (C language) Contents : - Variables, data types, assignments - Conditional structure (« if » statement, loops) - Arrays - Functions, - Programming algorithms (C language)	No prerequisites	1
Statistics	This course introduces students to the basic theory behind the development and assessment of statistical analysis techniques in the areas of point and interval estimation and hypothesis testing. Topics include: Point estimation methods, including method of moments and maximum likelihood; Bias and variance; Mean-squared error and the Cramer-Rao inequality; Sufficiency, completeness and exponential families; the Rao-Blackwell theorem and uniformly minimum variance unbiased estimators; Bayesian estimation methods; Resampling estimation methods, including the jackknife and the bootstrap; Confidence interval construction methods, including likelihood-based intervals, inversion methods, intervals based on pivots and simple resampling-based percentile intervals; Highest posterior density and Bayesian credibility regions; Likelihood ratio tests and the Neymann- Pearson lemma; Power calculations and uniformly most powerful tests; Rank-based non-parametric tests, including the sign-test and Wilcoxon tests. Learning Outcomes Upon successful completion of the requirements of this course, students should have the knowledge and skills to: - Explain the notion of a parametric model and point estimation of the parameters of those models. - Explain and apply approaches to include a measure of accuracy for estimation procedures and our confidence in them by examining the area of interval estimation. - Assess the plausibility of pre-specified ideas about the parameters of a model by examining the area of hypothesis testing. - Explain and apply the idea of non-parametric statistics, wherein estimation and analysis techniques are developed that are	Descriptive statistics, Probabilities, Linear model	2

	not heavily dependent on the specifications of an underlying parametric model. - Understand the computational issues related to the implementation of various statistical inferential approaches.		
Plant Reproduction systems	We will understand and appreciate differences in existing modes of reproduction. Sexual reproduction. Sexual life cycles. Structure of flower types. Gametogenesis. Pollination. Fertilization. - Sexual reproduction; Meiosis and fertilization; reproductive organs in flowering plants; plant sexual morphology. - Importance of reproductive systems for plant breeding. Distinction between cross-and self-pollination. Types of reproduction - Autogamy (definition), mechanisms promoting or preventing autogamy, self-incompatibility systems and implications for plant breeding, male-sterility systems. Genotype conversion. Artificial pollination. - Allogamy (definition). Promoting mechanisms. Implications for plant breeding. Inbreeding depression and hybrid vigor. - Control of hybridization in a perspective of seed production. Dioecy, self-incompatibility, nuclear and cytoplasmic male sterility.	No prerequisite	**2**
Plant genetics 1	Introduction to genetics, genes and chromosomes, Mendel's laws, probabilities in Mendelian inheritance, sex chromosomes, genetic linkage, Tetrad analysis, extra chromosomal inheritance, epigenetics, population genetics	Basics in genetics	**3**
Plant genetic resources and diversity	At the end of this course student will understand the Importance of germplasm in breeding projects. The different types of evaluation of a collection, morphological, chemical, technological, molecular and their representations. Allelic richness, diversity structure. How to manage and use the genetic diversity: core collection and sampling strategies. Programme : - Teaching of most adopted tool for evaluation of genetic diversity and construction of core collection. - These tools will be defined morphological, biochemical, technological and molecular studies to assess genetic diversity in germplasms also allelic richness and construction of a core collection. - Evolution of phenotypic and genetic diversities of commercial varieties. - Conservation of germplasm: mechanisms and global maintenance. Genetic resources context in evolution.	No prerequisite	**4**
Introduction to plant pathology	The objective is to study the principals of the plant-microorganisms interaction. It introduces the major plant pathogen groups (viruses, viroids, phytoplasmas, bacteria, fungi, nematodes and the higher plant parasites) and the abiotic plant stresses (caused by environmental factors). It introduces also the importance of the beneficial microorganisms (e.g. PGPR, Plant-growth-promoting-rhizobacteria & AM, arbuscular mycorrhizae). Students study the scientific classification of theses microorganisms, their detection and quantification, and the general methods of control (chemical, biological & genetic). During the practical work, students follow experiments of the plant-PGPR-pathogen interactions under the greenhouse conditions. They prepare the bacterial and fungal inoculum, inoculate plants (resistant and susceptible genotypes), and follow disease progression (visual symptoms, molecular and microscopic diagnosis). They learn the different microbiological methods (preparation media, isolation of microorganisms, replication of bacterial and fungal cultures, using microscopes (classical and electronic), DNA extraction and real time quantitative PCR).	No prerequisites	**3**

Breeding Strategies and methods of selection	Students will be able to define the breeding goals in the midterm and long term, reasoning the breeding strategy adapted to the objectives, species, germplasm, traits to be selected according to the dimension of the breeding program, breeding tools and selection methods. Programme: A course will introduce the cultivar types, deriving from breeding strategies and methods of selection adapted to self-pollinated and open-pollinated species. Practical examples of breeding projects for yield, quality, and resistance to biotic and abiotic stress will be detailed by professionals. Examples will cover Seed and vegetatively propagated species. 1. Breeding objectives, program design and management; The choices a breeder has to make, like choice of parents, type and size of populations, change in allele frequencies by selection, effect of crop type on breeding program. 2. Main breeding strategies; Based on examples on different crops, we will review the main strategies: bulk breeding, pedigree breeding, backcross breeding, recurrent selection and synthetic varieties, hybrid breeding and hybrid production systems, mutation breeding, chromosome breeding. 3. Breeding strategies for quality and fitting with technological uses 4. Breeding strategies for yield increase 5. Breeding strategies for disease resistance, major resistance gene vs polygenic resistance. 6. Breeding strategies for tolerance to abiotic stress (drought tolerance, low nitrogen and phosphorus tolerance). 7. Breeding for low-input and for organic; Specific developments like evolutionary breeding for diversity and participatory breeding will be described. 8. Breeding for multiple purposes; we will analyse the importance of prioritizing selection among traits.	No prerequisites	**5**