Master in Forestry Engineering
Course information
Year 2018-19

GENERAL SPECIFICATIONS			
English name			
Biotechnology and Genetic Improvement in Forestry			
Spanish name			
Biotecnología y Mejora Genética en el Ámbito Forestal			
Code	**Type**		
1150106	Compulsory		
Time distribution			
	Total	**In class**	**Out class**
Working hours	100	40	60
ECTS: 4			

Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
2.2	0	0.8	0.6	0.4

Departments	**Knowledge areas**
Agroforestry Sciences	Environmental technologies/Agroforesty engineering
Year	**Semester**
1º	2º

TEACHING STAFF			
Name	**E-Mail**	**Telephone**	**Office**
Raul Tapias	rtapias@uhu.es	959217564	STPB35
Vázquez Ortiz, Encarnación	encarni@uhu.es	959217526	STPB-21

SPECIFIC INFORMATION OF THE COURSE

1. Contents description

1.1. In English:

Theoretical and practical background of plant biotechnology.
Basics and techniques used in genetic engineering for application in forestry and natural environment
General principles of plant selection and breeding applied in forestry and natural environment
Main types of cultures in vitro. Techniques required for its establishment, analysis and evaluation
Major plant micropropagation techniques
Design and application of micropropagation protocols
Relevant aspects of the control of secondary metabolism in vitro plant cultures
Design and implementation of production processes.

1.2. In Spanish

Bases teóricas y prácticas de la biotecnología vegetal y herramientas de las que se vale dicha disciplina
Técnicas de las que se vale la ingeniería genética de y fundamentos necesarios para su

aplicación en el ámbito forestal y natural
Principios generales de la selección y mejora genética vegetal y la particularidad de aplicación en el ámbito forestal y natural
Principales tipos de cultivos in vitro y las técnicas necesarias para su establecimiento, análisis y evaluación
Principales técnicas de micropropagación de plantas
Diseño y aplicación protocolos de micropropagación
Aspectos relevantes del control del metabolismo secundario en cultivos vegetales in vitro
Diseño y aplicación de procesos de producción

2. Background

2.1.Situation within the Degree:

The course is a basic subject of the first year of the Master. The course requires knowledge of plant anatomy and plant physiology, genetic, plant breeding and statistics. Their contributions are essential as a base for the student to be able to know, design and apply biotechnological processes in forest plants..

2.2. Recommendations:

There are no specific prerequisites, but it is highly recommended that students have a background in technical or science subjects at Degree level, as well as in subjects of plant anatomy, plant physiology, genetic, plant breeding and statistics

3. Objectives (as result of teaching):

The student who passes this course must be able to know, design and apply biotechnological processes in the forest plants. Likewise, they will know the techniques for its application in the selection, improvement and conservation of forest genetic resources. All this, with sufficient technical capacity for its application in the national and international levels and knowing the occupational and environmental risks that such activity may entail

4. Skills to be acquired

4.1. Specific Skills:

CEPF06: Adequate knowledge and ability to develop and apply technology in: forest breeding

4.2. General Skills:

CB6: To acquire and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context
CB7: That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study
CB8: That students are able to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments
CB9: That students know how to communicate their conclusions and the knowledge and ultimate reasons that sustain them to specialized and non-specialized audiences in a clear and unambiguous way
CB10: That the students possess the learning skills that allow them to continue studying in a partially self-directed or autonomous way.
CG6: Ability to develop techniques and projects in the field of forest genetics
CT2: Ability to read documents, write texts and communicate orally in English
CT4: Capacity for autonomous learning and decision making
CT9: Analysis and synthesis capacity
CT10: Respect for and promotion of human rights, democratic principles, the principles of equality between men and women, solidarity and universal accessibility

5. Training Activities and Teaching Methods

5.1. Training Activities:

Theory clases on the contents of the Program.
Problem Solving sessions.
Practical sessions in specialized laboratories or computer rooms.
Field sessions to approach the industrial reality.
Activities Academically Directed by the Faculty: seminars, conferences, development of works, debates, collective tutorials, evaluation activities and self-evaluation

5.2. Teaching Methods:

Theory classes
Practical lessons in the laboratory
Work in groups
Practical work
Field training

5.3. Development and Justification:

1. Theory classes

There will be 20 hours of lessons in which the theoretical base of the subject will be explained, with the aid of board work and computer presentations. Participation of the students is highly encouraged and will form part of the evaluation. This activity develops CEPF06, CG6, CB7, CT9, CB6 skills.

2. Practical lessons in the laboratory

There will be 2 four-hour sessions in the laboratory. These practical lessons will consist in in vitro culture. Also There will be 2 two-hour session for solving practical tasks. (CEPF06, CG6,C B7, CB6 skills)

3. Work in groups

There will be two tasks for students to carry out in small groups: (CB9, CB8, CB10, CB7,CT9, CB6)

4. Practical work

For the practical section of this course, the students will be required to describe the methodology and results of an experiment of in vitro culture according different information that they have gathered and managed. (CB9, CB10, CT4, CT2, CT10, CEPF06, CG6, CB7, CT9, CB6)

5. Field training

There will be a field trip (1 day) in the province of Huelva in order to know examples on plant breeding. (CB7, CEPF06,CG6, CT9, CB6)

6. Detailed Contents:

THEORY

Part I. BIOTECHNOLOGY IN THE FOREST AREA

1. Introduction. Biotechnology: concept, nature and historical development. Living beings: cellular and molecular level. Structure of nucleic acids. Replication. Transcription. Translation. Current biotechnology. Genetic engineering. Genetic improvement of forest species: objectives and limitations. Contributions of Biotechnology.

2. Genetic engineering. Molecular tools and methods of isolation, characterization and manipulation of DNA. Protocol for the generation of DNA recombinant. Vectors Isolation. Restriction enzymes. Ligases. DNA Recombinant technology. Cloning of genes. Hybridization. Molecular analysis of DNA, RNA and proteins. DNA amplification. Genetic markers: concept and applications. Types.

3. In vitro culture of tissues. Concept and foundation. Morphogenesis Growth and differentiation in vitro. Explants. Culture media Applications: production and improvement.

Micropropagation: concept, stages and factors. Regeneration paths. Meristem culture. Germplasm conservation in vitro. Obtaining doubled haploids. Sexual hybridization, Somatic Hybridization Somaclonal variation.
4. Transgenesis Objective. Basis and Methods. Requirements. DNA transfer systems. Agrobacterium tumefaciens. Biobalistic Applications: Modifications in Growth and Development. Resistance to pests and diseases. Tolerance to high and low temperatures, salinity and drought. Modification of the lignin and cellulose content. Phytodecontamination.
5. Proteomics Concept. Methodology for the analysis of the proteome. Applications: Regulation of Xylogenesis, Formation of tension wood. Juvenile and adult wooden proteomes. Proteomics and Response to water stress.

Part II:. FOREST BREEDING
6. Introduction to forest breeding. Concept and objectives of breeding. Advantages and Limitations. Basic terminology. The breeding cycle.
7. Genetic structure of forest stands. Genetic bases of breeding. Variability. Quantitative genetics: Components of the phenotypic variance. Heritability. Selection of the base population. Genetic values of parents. breeding Indicators.
8 Genetic tests Concept and objectives. Essays on the introduction of species, provenances and progenies, clonal tests. Designs of crosses. Experimental design. Analysis of genetic tests.
9. Reproduction of the selected material. Seed orchards, clonal reproduction. Progenitors
10. Breeding methods Asexually propagated species: Clonal Selection and Hybridization. Sexually propagated species: - Autogamous. Masal selection. Selection of pure lines. Hybridization; - Allogamous - Masal Selection, of Progenies, Recurrent. Hybridization.

LABORATORY AND COMPUTER TRAINING PROGRAM
Selection and preparation of individuals for their in vitro propagation
Preparation of culture media and laboratory procedures for in vitro culture.
In vitro implantation
in vitro multiplication
Rooting and acclimatization of plants produced in vitro
Analysis of breeding trials I
Analysis of breeding trials II

7. Bibliography

7.1. Basic Bibliography

Seguí Simarro, J. M. 2011. Biología y biotecnología reproductiva de las plantas. Valencia : Editorial de la Universidad Politécnica de Valencia,

Renneberg, R. 2009. Biotecnología para principiantes . Barcelona : Reverté,.XI, 300 p.

Benítez Burraco, A.. 2005. Avances recientes en biotecnología vegetal e ingeniería genética de plantas. Barcelona : Reverté, 196 p.

Martos Núñez, V. M. y García del Moral L. Prácticas de biotecnología vegetal : plan de prácticas-memoria-diario. Granada :Universidad de Granada, 68 p.

Griffiths A.F., Wessler S.R., Lewontin R.C., Carroll S.B. 2008. Genética. Madrid : McGraw-Hill Interamericana de España, 841 p

Cubero Salmerón, J. I. 2003. Introducción a la mejora genética vegetal. Madrid : Mundi-Prensa, , 567 p

Falconer D.S., Trudy F.C. Mackay 2001. Introducción a la genética cuantitativa. Zaragoza : Acribia. 469 p.

Caujapé-Castells, J. 2006. Brújula para botánicos desorientados en la genética de poblaciones. Las Palmas de Gran Canaria. Exegen Ediciones. 132 p.

7.2. Additional Bibliography:

Castillo Rodríguez F. (coord.) 2005. Biotecnología ambiental, Madrid : Tébar, 614 p.

Kreuzer, H. 2004 ADN recombinante y biotecnología : guía para estudiantes. Zaragoza : Acribia,, 449 p.

Caballero, J.L., Valpuesta V., Muñoz J., Blanco J. 2001. Introducción a la biotecnología

vegetal: métodos y aplicaciones. Córdoba : Publicaciones Obra Social y Cultural Cajasur, 406 p.

Fita Fernández A.M., Rodríguez Burruezo A., Prohens Tomás J. 2008. Genética y mejora vegetal. Universidad Politécnica de Valencia, 190 p.

Viseras Alarcón, E 2008. Cuestiones y problemas resueltos de genética . Universidad de Granada, 285 p

Ménsua Fernández J.L. 2003. Genética : problemas y ejercicios resueltos. Madrid : Pearson Educación. 386 p.

Nuez F., Pérez de la Vega M.,. Carrillo J.M (Ed)- 2004. Resistencia genética a patógenos vegetales. Universidad Politécnica de Valencia. 568 p.

8. Systems and Assessment Criteria

8.1. System for Assessment:

1. Theory and practical written assessment

2. Practical work

3. Participation and interest

1. Theory and practical written assessment

This exam represents 60% of the final mark. To pass the subject it is necessary to obtain at least 5 out of 10 in this exam. (**CEPF06,CG6,CB7, CB6 skills)**

2. Practical work

The mark for this work represents 30% of the final mark. The mark is from 0 to 10 and to pass the subject it is necessary to obtain at least 4 points (**CB9, CB10, CT4, CT2, CT10, CEPF06, CG6, CB7, CT9, CB6 skills).**

3. Participation and interest

The active participation and interest in the subject demonstrated by students will be evaluated, (**CT4, CT10, CG6, CB7, CT9**)

Final mark

The final mark for the subject will be obtained thus: 0.6 x A + 0.3 x B + 0.1 x C,

where A is the mark for the theory-practical written exam. B is the mark for the practical work and C is the teacher's evaluation of the interest and active participation of the student.

To pass the subject, students have to obtain at least 5 points in the final mark, with at least 4 points in the grades for B and C.

Alternative modality for evaluation of practical lessons (Practical work):

Those students who cannot attend classes, for work, health or other reasons included in Article 8 of the Regulations for the Degree and Official Master's Degrees of the University of Huelva (approved by the Government Council of July 16, 2009) (Modification approved by the

Government Council of July 29, 2016), must:

1. To communicate it to the coordinator of the subject as soon as the circumstance arises.

2. To carry out a bibliographic work related to the practices of the subject. The teacher will offer several alternatives taking into account the interest of the student.

3. To inform the professor of practices on the development of work at least two times during the course.

4. To deliver the bibliographic work before the official exam dates.

5. To be willing to verbally explain some aspects of the work if requested by the teacher.

Final results will be given in terms of a numerical scale between 0 and 10 (including tenths), with the corresponding qualitative ratings below:

≤4.9: Fail (D)

5.0 -6.9: Pass (C)

•7.0 -8.9: Pass with Merit (B)

•9.0 -10: Distinction (A)