



Proyecto/Guía docente de la asignatura				Project/Course Syllabus
Asignatura <i>Course</i>	Molecular Techniques and Diagnostic			
Materia <i>Subject area</i>				
Módulo <i>Module</i>	Optativo			
Titulación <i>Degree Programme</i>	Grado en Ingeniería Forestal y del Medio Natural Semestre Internacional de la ETS Ingenierías agrarias			
Plan <i>Curriculum</i>	449 / 903	Código <i>Code</i>	42212	
Periodo de impartición <i>Teaching Period</i>	2nd semester	Tipo/Carácter <i>Type</i>	Elective	
Nivel/Ciclo <i>Level/Cycle</i>	Grade	Curso <i>Course</i>	4º	
Créditos ECTS <i>ECTS credits</i>	3			
Lengua en que se imparte <i>Language of instruction</i>	English			
Profesor/es responsable/s <i>Responsible Teacher/s</i>	Jonatan Niño Sánchez PhD candidate			
Datos de contacto (E-mail, teléfono...) <i>Contact details (e-mail, telephone...)</i>	jonatan.nino@uva.es +34979108416			
Departamento <i>Department</i>	Plant Production and Forest Resources			
Fecha de revisión por el Comité de Título <i>Review date by the Degree Committee</i>	30 de junio de 2026			



1. Situación / Sentido de la Asignatura

Course Context and Relevance

1.1 Contextualización

Course Context

Biotechnological tools such as molecular markers and diagnostic techniques are essential in modern forest science. They allow early detection and prevention of plant diseases, identification of pathogens and invasive species, support in resistance breeding programs, and traceability in forest products. This course provides applied knowledge highly relevant for future professionals in both management and research in forest pathology and biotechnology.

1.2 Relación con otras materias

Connection with other subjects

This course complements both basic and applied subjects such as:

- Forest Botany, Zoology, Plant Biology
- Conservation and Breeding of Genetic Resources
- Forest Pests and Diseases
- Integrated Pest Management

1.3 Prerrequisitos

Prerequisites

It is recommended to have passed basic biology-related subjects (Forest Botany and Zoology and Forest Pathology and Pests)



2. Resultados del proceso de formación y de aprendizaje (RD 822/2021) o competencias (RD 1393/2007)

Learning outcomes (RD 822/2021) or competences (RD 1393/2007)

2.1 (RD1393/2007) Competencias Generales

General Competences

All general competences (G1 to G27) will be fulfilled. Especially:

- G3: Ability to analyze and synthesize.
- G5: Oral and written communication in technical and non-technical contexts.
- G15: Critical reasoning and autonomous learning.

2.2 (RD1393/2007) Competencias Específicas

Specific Competences

- Understand molecular and genetic techniques for forest pathology.
- Apply these tools to solve real-world phytosanitary problems.
- Design basic diagnostic protocols compatible with sustainable forest management.



3. Objetivos

Course Objectives

By the end of the course, students will be able to:

1. Identify and explain major molecular diagnostic tools used in forest pathology.
2. Apply molecular techniques to detect pathogens and support disease resistance.
3. Design a diagnostic protocol using appropriate markers for a given problem.
4. Evaluate advantages and limitations of molecular vs traditional diagnostic methods.
5. Communicate their findings effectively in a scientific format.



**4. Contenidos y/o bloques temáticos****Course Contents and/or Modules****Module 1: Concepts and foundations of molecular diagnostics in forest pathology**

Carga de trabajo en créditos ECTS: 1
Workload in ECTS credits:

a. Contextualización y justificación**a. Context and rationale**

This block introduces the fundamental principles of molecular biology and its application to the diagnosis of forest diseases. It provides the theoretical foundation needed to understand modern diagnostic tools and their role in sustainable forest health management.

b. Objetivos de aprendizaje**b. Learning objectives**

1. Understand key concepts and terminology in molecular diagnostics.
2. Identify contexts where molecular tools are relevant in forestry.
3. Distinguish molecular vs classical pathogen identification methods.

c. Contenidos**c. Contents**

- Molecular markers: definitions and types
- Diagnostic strategies in plant pathology
- Applications in forest health monitoring and invasive species detection

d. Métodos docentes**d. Teaching and Learning methods**

See section 5

e. Plan de trabajo**e. Work plan**

See section 6

f. Evaluación**f. Assessment**

See section 7

Module 2: Techniques in molecular diagnostics and pathogen detection



Carga de trabajo en créditos ECTS: 1,5
Workload in ECTS credits:

a. Contextualización y justificación**a. Context and rationale**

Focuses on laboratory techniques used in forest disease diagnosis: DNA extraction, PCR, qPCR, gel electrophoresis, and sequencing. Practical applications to the detection of phytopathogens in forest ecosystems.

b. Objetivos de aprendizaje**b. Learning objectives**

1. Apply molecular techniques to diagnose forest pathogens.
2. Interpret experimental results from PCR and related methods.
3. Operate basic lab equipment and follow protocols.

c. Contenidos**c. Contents**

- DNA-based detection (PCR, qPCR, multiplex)
- Electrophoresis and result interpretation
- Pathogen traceability and certification
- Use of databases

d. Métodos docentes**d. Teaching and Learning methods**

See section 5

e. Plan de trabajo**e. Work plan**

See section 6

f. Evaluación**f. Assessment**

See section 7

Module 3: Genetic engineering and biotechnology in forest disease management

Carga de trabajo en créditos ECTS: 0,5
Workload in ECTS credits:

a. Contextualización y justificación**a. Context and rationale**

Covers biotechnological tools used to improve resistance and control forest diseases: CRISPR/Cas, RNAi, transgenics, and biocontrol agents. Addresses ethical, legal, and ecological implications.

b. Objetivos de aprendizaje**b. Learning objectives**



1. Explain applications of genetic engineering in forest health.
2. Evaluate risks and benefits of biotechnology in forestry.
3. Communicate biotechnology-based proposals in a scientific format.

c. Contenidos

c. Contents

- Resistance breeding and molecular tools
- Hypovirulence and biocontrol strategies
- Forest bioengineering: opportunities and challenges

d. Métodos docentes

d. Teaching and Learning methods

See section 5

e. Plan de trabajo

e. Work plan

See section 6

f. Evaluación

f. Assessment

See section 7

g Material docente

g Teaching material

g.1 Bibliografía básica

Required Reading

- Agrios, G. N. (2024). Agrios' Plant Pathology (6.^a ed.). Edited by por Richard Oliver. Academic Press.
- Lodish, H., Berk, A., Kaiser, C. A., et al. (2021). Molecular Cell Biology (9.^a ed.). W. H. Freeman.
- Brown, T. A. (2016). Gene Cloning and DNA Analysis: An Introduction (7.^a ed.). Wiley.
- Nowicki, M., & Kozik, E. (2023). Molecular Plant Pathology: Techniques and Applications. Springer.
- Wintheiser, T. (2023). Forest Genetics and Tree Breeding. White Press Academic.

g.2 Bibliografía complementaria

Supplementary Reading

- EPPO (2023). Diagnostic Protocols for Regulated Pests. Available at: <https://www.eppo.int>
- Lebedev, V., Juncic, S., & Grattapaglia, D. (2024). Genomic selection in forest trees comes to life: unraveling its potential. *Frontiers in Plant Science*, 15, 1462285.
- Frankham, R., Ballou, J. D., & Briscoe, D. A. (2010). Introduction to Conservation Genetics (2.^a ed.). Cambridge University Press.
- Neale, D. B., & Kremer, A. (2011). Forest tree genomics: growing resources and applications. *Nature Reviews Genetics*, 12(2), 111–122.
- Janse, J. D., & Wenneker, M. (2020). Plant Pathogenic Bacteria: Genomics and Molecular Biology. Caister Academic Press.
- Kennedy, D. (2007). Writing and Using Learning Outcomes. EUA.

g.3 Otros recursos telemáticos (píldoras de conocimiento, blogs, videos, revistas digitales, cursos masivos (MOOC), ...)

Additional Online Resources (microlearning units, blogs, videos, digital journals, massive online courses (MOOC), etc.)

- NCBI GenBank and Primer-BLAST – Comprehensive nucleotide sequence databases and primer design tools.
- <https://www.ncbi.nlm.nih.gov>
- TreeGenes Database – Genomic and phenotypic data for forest tree species.
- <https://treegenesdb.org>
- FAO Forest Health Platform – Technical resources on forest pest diagnostics, monitoring, and biosecurity.
- <https://www.fao.org/forestry/foresthealth>
- EPPO Global Database – Official diagnostics, pest distribution, and phytosanitary protocols.
- <https://gd.eppo.int>
- Moodle UVa Virtual Campus – Access to teaching materials, announcements, discussion forums, peer assessments, and feedback.
- PI@ntNet – Collaborative platform for plant species identification and phenotypic documentation.
- <https://identify.plantnet.org>

h. Recursos necesarios

Required Resources

i. Temporalización

Course Schedule

CARGA ECTS <i>ECTS LOAD</i>	PERIODO PREVISTO DE DESARROLLO <i>PLANNED TEACHING PERIOD</i>
3	Second quarter

5. Métodos docentes y principios metodológicos

Instructional Methods and guiding methodological principles

Guiding Methodological Principles

- Student-centered learning: The student takes an active role in constructing knowledge through meaningful engagement with real-world tasks.
- Progressive cognitive development: Learning activities promote progression from basic understanding to synthesis and critical evaluation.
- Alignment between teaching, learning outcomes and assessment: All teaching activities are explicitly designed to support the achievement of learning outcomes and the development of competences.
- Scientific literacy and communication: Students are trained to understand, apply, and communicate scientific information effectively.
- Integration of ethics and sustainability: Biotechnological and diagnostic practices are discussed within the framework of environmental sustainability and professional ethics.
- Interdisciplinary perspective: Content connects molecular diagnostics with forest pathology, genetics, conservation, and biotechnology.

Instructional Methods Used

- Interactive lectures: Short theoretical inputs combined with open questions and concept mapping.
- Flipped classroom: Students review materials before class; in-class time focuses on application and problem-solving.
- Laboratory sessions: Hands-on experience with molecular techniques such as PCR, DNA extraction, and electrophoresis.

6. Tabla de dedicación del estudiantado a la asignatura

Student Workload Table

ACTIVIDADES PRESENCIALES o PRESENCIALES o A DISTANCIA ⁽¹⁾ FACE-TO-FACE/ ON-SITE or ONLINE ACTIVITIES ⁽¹⁾	HORAS HOURS	ACTIVIDADES NO PRESENCIALES INDEPENDENT / OFF-CAMPUS WORK	HORAS HOURS
Theoretical sessions	15	Independent study and reading assignments	30
Laboratory sessions	15	Laboratory report writing	15
Total presencial <i>Total face-to-face</i>	30	Total no presencial. <i>Total non-face-to-face</i>	45
TOTAL presencial + no presencial <i>Total</i>			75

7. Sistema y características de la evaluación

Assessment system and criteria

INSTRUMENTO/PROCEDIMIENTO ASSESSMENT METHOD/PROCEDURE	PESO EN LA NOTA FINAL WEIGHT IN FINAL GRADE	OBSERVACIONES REMARKS
Written exam	40 %	Short-answer questions on conceptual content
Lab report	60 %	

CRITERIOS DE CALIFICACIÓN ASSESSMENT CRITERIA
• Convocatoria ordinaria. First Exam Session (Ordinary) ○ ... • Convocatoria extraordinaria^(*) Second Exam Session (Extraordinary / Resit) ^(*): ○ ...

8. Consideraciones finales

Final remarks

The use of Generative Artificial Intelligence (AI) is permitted for certain tasks in this course. To find out which tasks allow its use, it is advised to carefully review the specific instructions for each task when they are posted



on the virtual campus, announced in class, included in the course schedule, and/or detailed in the syllabus. It is recommended to use only the tools for which the University of Valladolid holds a license and to understand the implications of each license regarding privacy and data usage by these tools. It is the student's responsibility to be aware of these specific permissions. Each assignment must include a declaration of which specific tools were used and how Generative AI was employed. The exact format for this declaration will be announced in due course in class and on the virtual campus.

