

COURSE OF STUDY: Plant Medicine (LM69, MdP)
ACADEMIC YEAR: 2023-2024
ACADEMIC SUBJECT: Diagnosis in Plant Pathology
**LAUREA MAGISTRALE
MEDICINA DELLE PIANTE
MASTER DEGREE
PLANT MEDICINE**


General information	
Year of the course	1 st year
Academic calendar (starting and ending date)	II semester – 2024 February 26th – June 14th (Pause 2024 April 22 nd – May 3 rd , for midterm exam)
Credits (CFU/ETCS):	6
SSD	AGR/12 – Plant Pathology
Language	Italian (English will be used when required if foreign students will attend the course and mainly in the didactic material)
Mode of attendance	Not mandatory but suggested

Professor/ Lecturer	
Name and Surname	Stefania POLLASTRO
E-mail	stefania.pollastro@uniba.it
Telephone	080 5442910 – 3391855984
Department and address	Department of Soil, Plant and Food Sciences - first plexus, Plant Pathology Section, Third floor room n.1
Virtual room	Teams platform entry code azivdyz
Office Hours (and modalities: e.g., by appointment, on line, etc.)	From 9.00-13.00 from Monday to Friday according to an established appointment requested by phone or e-mail. Tutoring could be also on e-learning platforms (Teams) at different times by appointment. Other tutoring methods can be defined on demand.

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	24	42	84
CFU/ETCS			
6	3	3	6

Learning Objectives	The course, in the frame of plant protection area, aims to provide in-depth knowledge on biological, biochemical, serological, molecular methodologies, image analysis and nanotechnology for the diagnosis of plant pathogens.
Course prerequisites	Basic knowledge on biology, botany, plant physiology, general plant pathology, mycology, bacteriology, virology, and special plant pathology.

Teaching strategies	The course topics will be treated with the help of <i>powerpoints</i> , working groups, study-cases, the critical analysis of scientific papers and with the support of external experts with seminar activities. Classroom, laboratory, and field exercises will be used in transferring competence on diagnostic tools. The self-direction, teamwork, self-assessment, and the use of technologies will be promoted. For foreign students (LLP-Erasmus, etc.), teaching material will be supplied in English, and the tutoring will be done in English.
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	<p>For students with disabilities and SLD, the teacher will adjust the teaching methods and teaching materials to the specific learning need.</p> <p>E-learning using public (eg Teams) platforms can be used, on demand as additional tutoring activities for working students, athletes and students with babies, as well as front-office activity</p>
Expected learning outcomes in terms of	<p>Expected learning outcomes, knowledge and ability are indicated for each Dublin Descriptor (DD) according to the ones reported in the Art.4 of the Didactic Regulation of the master's degree course Plant Medicine</p>
DD1 - Knowledge and understanding on:	<ul style="list-style-type: none"> ○ methods and techniques that can be used for the diagnostic assessment (field, monitoring, surveillance, quarantine) ○ methods and techniques that can be used to identify the causal agents of disease
DD2 - Applying knowledge and understanding on:	<ul style="list-style-type: none"> ○ know how to apply the main methods of clinical plant pathology for detection, identification and characterization of plant disease and plant pathogens ○ know how to keep a sample ○ knowing how to make a correct request for a laboratory investigation from a substantial and formal point of view ○ knowing how to take, treat and store phytopathological samples for laboratory analyses ○ be aware of the sources of variability in the measurement of laboratory parameters dependent on the sample ○ be aware of the potential and limitations of the information provided by laboratory tests ○ know the fundamental interpretative criteria of a phytopathological report
Soft skills (DD3-DD5)	<ul style="list-style-type: none"> • DD3 - Making informed judgments and choices At the end of the course, the students will be able to <ul style="list-style-type: none"> ○ carry out a proper anamnesis on phytopathological cases ○ formulate a diagnostic hypothesis ○ select and apply the most appropriate diagnostic methodology for the reference context and most suitable for characterizing the causal agent of the disease/alteration, also being able to choose on the basis of the impact of the choice on social, ethical, environmental and sustainability factors • DD4 Communicating knowledge and understanding At the end of the course, the students will be able to <ul style="list-style-type: none"> ○ communicate in oral and written forms using technical language, ○ participate to multidisciplinary working groups ○ communicate the reasons for the choices made on the process adopted on a technical and economic level and on a human and ethical levels • DD5 Capacities to continue learning At the end of the course, the students will be able to <ul style="list-style-type: none"> ○ improve his/her proper knowledge consulting scientific and technical papers and websites to deepen and update his/her knowledge on diagnostic for plant pathogens ○ critically analyze the contents of presentations and communications in technical and scientific meetings <p>Expected learning outcomes, as knowledge and ability, are reported in the Art.4 of the Didactic Regulation of the course Plant Medicine (expressed by European Descriptors)</p>
Syllabus	
Content knowledge	Pre-analytical step (0.5 CFU)

	<ul style="list-style-type: none"> ○ medical history, symptoms and signs and factors that influence field symptoms (host, pathogen, environmental conditions) ○ areas of application of diagnostic assays (monitoring, surveillance, quarantine, technical assistance on-field) ○ sampling, collection, transport, storage and management of the sample <p>Analytical step (2 CFU):</p> <ul style="list-style-type: none"> ○ How, when, and why to use laboratory tests ○ Biological diagnosis: method of transmission of infectious agents; mechanical transmission; transmission by grafting (indexing); culture isolations, biochemical and olfactory assays ○ Serological diagnosis: direct serological techniques, indirect serological techniques ○ Microscopy: optical microscopy, electronic immunomicroscopy; ISEM - Immuno sorbent electron microscopy; decoration (detection of viruses with antibodies); DIP searches for viral particles from raw juice from leaves ○ Molecular diagnosis: conventional and innovative methods based on PCR (Nested-PCR, Colony PCR, RAPD, SCAR, qPCR, ddPCR, RT-PCR, LAMP, multiplex, etc.), electrophoretic analysis of nucleic acids of pathogens and viral (dsRNA) and viroidal RNAs; molecular hybridization); sequencing and NGS ○ Diagnostic imaging, biosensors, nanosensors ○ Portable devices <p>Post-analytical step (0.5 CFU):</p> <ul style="list-style-type: none"> ○ reporting and interpretation of the analytical results ○ quality criteria of phytopathology analysis laboratories and quality of analytical measurements (imprecision, exactness, accuracy, measurement errors, reference values) <p>Hands-on (3 CFU):</p> <p>In the hands-on part of the course, the student will be able to apply the main methods of isolation and cultivation of pathogens, and to understand, apply and compare the main diagnostic methods used in plant pathology for the diagnosis of diseases caused from viruses, bacteria, phytoplasmas and fungi. In addition, the student will be able to develop and design a diagnostic protocol, that, when possible, he will experiment in operational feasibility (i.e. observations of phytopathological samples and microscopic preparations, damage assessment, application PCR and its variants, ELISA, IoT). Hands-on will be on-field, in lab and in the classroom also group activities, critical analysis, comparison with the world of work and self-assessment.</p>
<p>Texts and readings</p>	<p>-Boonham N., Tomlinson J., Mumford R, 2016. Molecular methods in plant disease diagnostics: Principles and protocols.</p> <p>- Dehne H.-W., Adam G., Diekmann M., Frahm J., Mauler-Machnik A., van Halteren P., 1996. Diagnosis and Identification of Plant Pathogens, Proceedings of the 4th International Symposium of the European Foundation for Plant Pathology</p> <p>- Gullino M.L., Bonants P.J.M., 2015. Detection and Diagnostics of Plant Pathogens</p>
<p>Notes, additional materials</p>	<p>Scientific paper supplied by the professor</p> <p>Materials in English are additional and can be reference texts for incoming international students</p> <p>Scientific papers supplied by the professor</p> <p>Website examples</p> <ul style="list-style-type: none"> •http://bugs.bio.usyd.edu.au/learning/resources/PlantPathology/

	<ul style="list-style-type: none"> • http://erec.ifas.ufl.edu/plant_pathology_guidelines/index.shtml • http://issuu.com/scisoc/docs/43818/1 • http://ohioline.osu.edu/hyg-fact/3000/ • http://www.apsnet.org/edcenter/intropp/LabExercises/Pages/Cytology.aspx • http://www.apsnet.org/edcenter/instcomm/TeachingArticles/Pages/TeachingPlantDiseaseDiagnosis.aspx • http://www.plantpath.wisc.edu/PDDCEducation/MasterGardener/General/Slide1.htm
Repository	<p>Powerpoints are not usable as learning material but can help the student during own study and in the using of suggested materials (Book, scientific papers, website).</p> <p>These together with the works prepared by the students, bibliographic reviews and anything deemed useful are available on the teams platform, access code azivdyz in the folder identified with AA2023-2024, starting from the beginning of the didactic activity and it will remain available to students even beyond the end of the academic year of reference</p>

Assessment	
Assessment methods	<p>As reported in the Teaching Regulations of the CdLM MdP (Art. 4 and annexes 1 and 2) the exam consists of an oral exam, with the presentation of an application project (project work) on the topics developed during the theoretical and practical lessons exercises in the classroom, in the field and in the laboratory and in the resolution of a case study.</p> <p>Only the students enrolled in the academic year during which this module is provided, can have a midterm exam during the time of teaching. (in the pause time 22/04/2024 - 3/05/2024). The result of it remains valid for the whole academic year and concurs to the final evaluation of the student (in proportion to the ECTS evaluated during the midterm exam).</p> <p>The exam, as well the midterm exam, consists of an oral test, including the presentation of an application project, with questions related to the lectures and visits, such as reported in the Didactic Regulation in Plant Medicine (art.4) and in the syllabus (annex 1). The exam consists of four questions and discussing his own project work. Overall, three questions will be asked and each student will also have to discuss the work carried out independently (project work) which cannot exceed 7 minutes in the presentation.</p> <p>If the midterm exam is taken, the assessment of the profit exam is expressed as an average between the mark given on the exemption and the profit exam.</p> <p>For Foreign students the midterm exam as well as the exam could be in English, and if, required as written test articulated as detailed before.</p>
Assessment criteria	<p>For each expected learning outcome indicated above, it is detailed below what the student is expected to know or be able to do and at what level in order to demonstrate that a learning outcome has been achieved and at what level</p> <ul style="list-style-type: none"> • Knowledge and understanding <ul style="list-style-type: none"> ○ Evaluation of knowledge and understanding on methods and techniques that can be used for the diagnostic assessment; to identify the causal agents of disease. • Applying knowledge and understanding <ul style="list-style-type: none"> ○ evaluation of the ability to apply the different techniques to detect, identify and characterize plant pathogens (viruses, bacteria, fungi, etc.). • Autonomy of judgment <ul style="list-style-type: none"> ○ assessment of the ability to analyze a phytopathological study case suggesting the appropriate solution.

	<ul style="list-style-type: none"> • Communicating knowledge and understanding <ul style="list-style-type: none"> ○ evaluation of the personal ability to communicate in oral form using technical language, to participate to multidisciplinary working groups. • Communication skills <ul style="list-style-type: none"> ○ ability to organize the acquired knowledge for educational-training purposes as well as for technical reports. • Capacities to continue learning <ul style="list-style-type: none"> ○ evaluation of the ability to learn diagnostic protocols for plant pathogens and traditional.
Final exam and grading criteria	<p>The final mark is given out of thirty. The exam is considered passed when the grade is greater than or equal to 18. The final mark will consider the theoretical and practical knowledge acquired, the ability to apply the knowledge, autonomy of judgment, communication skills and on the ability to integrate the acquired knowledge in a project work. The evaluation of the student is based on criteria previously fixed such as reported in the Art.4 of the Didactic Regulation of the Master's degree Course in Plant Medicine.</p>
Further information	