

COURSE OF STUDY Management of Green Spaces, Forests and Protected Areas

ACADEMIC YEAR 2023-2024

ACADEMIC SUBJECT Laboratory of Territory Analysis by Drones (Module of the I.C. Environmental monitoring and survey laboratory – ECTS 9)

General information	
Year of the course	1 st year
Academic calendar (starting and ending date)	2° semester (from march 04, 2024, to June 14, 2024)
Credits (CFU/ETCS):	3
SSD	AGR09
Language	Italian
Mode of attendance	optional

Professor/ Lecturer	
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Department and address	Dept. of Soil, Plant and Food Science
Virtual room	7bxi8y9
Office Hours (and modalities: e.g., by appointment, on line, etc.)	Every Friday 10.30 – 12.30 according to an established appointment requested by phone or e-mail. Tutoring could be also on e-learning platforms

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
75	0	42	33
CFU/ETCS			
3	0	3	

Learning Objectives	Knowing and understanding the constructive and functional aspects of unmanned aerial vehicles (drones), the legislation in force for their safe use in the agroforestry sector, as well as the processing of multi-spectrum images, taken using on-board cameras, aimed at the territory analysis
Course prerequisites	It is a first-year exam, second semester, there are no specific prerequisites different from those required for access to the bachelor course

Teaching strategie	<p>The expected results concern using drones to carry out remote sensing in the agricultural and forestry sectors. Therefore, teaching will essentially be based on:</p> <p>a) the development of theoretical-practical topics with the aid of PowerPoint presentations to be carried out in the laboratory; b) group exercises to be carried out in open field to plan and carry out short drone flight missions; c) laboratory processing with ad hoc software for analysing the images taken by the multi-spectrum cameras mounted on board the drone itself.</p> <p>The topics of the course will be treated with the help of Power Point presentations.</p> <p>All students will be able to receive a copy of the Power Point presentations used</p>
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	during lectures.
Expected learning outcomes in terms of	The expected results concern using drones to carry out remote sensing in the agricultural and forestry sectors.
Knowledge and understanding on:	<ul style="list-style-type: none"> ○ Knowledge and ability to understand the construction and functional aspects of remotely piloted aircraft (drones). ○ Knowledge and understanding of the legislation in force for their safe use in the agroforestry sector. ○ Knowledge and understanding of multi-spectrum image processing, taken by on-board cameras, aimed at land analysis.
Applying knowledge and understanding on:	<ul style="list-style-type: none"> ○ Knowledge and skills of piloting a drone, maintaining a pre-established flight path in both manual and automatic modes. ○ Knowledge and ability to plan a drone flight mission for remote sensing purposes in the agro-forestry sector. ○ Knowledge and ability to process multi-spectrum images through dedicated software and to calculate the different vegetation indices.
Soft skills	<ul style="list-style-type: none"> • <i>Making informed judgments and choices</i> <ul style="list-style-type: none"> ○ Ability to critically analyse and interpret remote sensing data collected by drone concerning agro-forestry territories. ○ Ability to work independently and in groups in driving drones and in the numerical analysis of images • <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ Ability to present and argue on issues related to the use of drones and processing of the related captured images. ○ Communication and relationship skills within a multidisciplinary work group and judgment skills both on a technical and economic level and on a human and ethical one. • <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ Ability to independently learn the progress of technology related to the use of drones ○ Ability to learn new information technologies related to image processing for the study of remote sensing of agricultural and forestry land.
Syllabus	
Content knowledge	<ul style="list-style-type: none"> ○ Elements of aerodynamics and air navigation ○ Drone components ○ RGB and multi-spectrum cameras used on board of drones ○ Legislative reference framework ○ Planning a drone flight ○ Operative examples of automatic flight ○ Flight operative examples by using Waypoints ○ Use of Pix4D Mapper image processing software
Texts and readings	<ul style="list-style-type: none"> ○ Lecture notes and course materials distributed in class ○ T. Kilby, B. Kilby “Guida pratica ai droni”. Tecniche Nuove Editore, Milano, 2016 ○ M. Miceli “Aerofotogrammetria con i droni”. Flaccovio Editore, Palermo, 2019 ○ Pix4Dmapper 4.1 User Manual
Notes, additional materials	
Repository	<ul style="list-style-type: none"> ○ Course participants will have the opportunity to use the Pix4dMapper software. ○ The teaching material (Power Point and Pix4DMapper Manual) will be available on Teams

Assessment	
Assessment methods	<p>The exam consists of an oral test on the topics developed during the course as reported in the Teaching Regulations of the Degree Course in Management of Green Spaces, Forests and Protected Areas.</p> <p>The assessment of the student's preparation takes place on the basis of pre-established criteria, as detailed in the Educational Regulations of the Degree Course in Management of Green Spaces, Forests and Protected Areas. A minimum of 4 questions will be asked, 3 of which on the components of the drone, on the relative legislation in force, on flight planning and 1 will concern the methods of image processing.</p> <p>For students enrolled in the year of the course in which the teaching is carried out, an intermediate test will be held which will take place in the period from April 29, 2024 to May 10, 2024. This intermediate test consists of an oral exam on the topics developed during the hours of the course carried out up to the date of the intermediate test itself. The outcome of this test contributes to the assessment of the profit exam and is valid for one academic year. The assessment of the student's preparation is expressed with a vote out of thirty. The intermediate test is passed with a vote of at least 18/30.</p>
Assessment criteria	<ul style="list-style-type: none"> • <i>Knowledge and understanding</i> <ul style="list-style-type: none"> ○ The knowledge and understanding of the concepts related to the use of drones for the analysis of the territory, as illustrated during the course, will constitute the elements for the basic assessment of the student. • <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> ○ A further element of assessment will be the ability to apply the concepts learned for the solution of application problems. • <i>Autonomy of judgment</i> <ul style="list-style-type: none"> ○ The ability to choose the most suitable methodology for both carrying out drones' flights and image processing will constitute another essential element of assessment. • <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ A further element of assessment will be the student's ability to explain the concepts learned and the adopted solution methodologies. • <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ The ability to learn new concepts on the use of drones and image processing for remote sensing based on the acquired knowledge will eventually highlight the higher level of learning.
Final exam and grading criteria	<p>The exam consists of an oral test on the topics developed during the course. The assessment of the students' preparation is expressed with a vote out of thirty. The test is passed with a vote of at least 18/30.</p> <p>For students who have taken the intermediate test, the assessment of the profit exam is expressed as the average of the marks obtained in the two oral tests. In case of maximum grade (30/30) honours can be awarded. The oral tests are public.</p> <p>The assessment of the student's preparation takes place on the basis of pre-established criteria, as detailed in the Educational Regulations of the Degree Course in Management of Green Spaces, Forests and Protected Areas. The profit exam for foreign students can be carried out in English.</p>
Further information	