Syllabus

Course Description

Course Title	Smart agricultural technologies
Course Code	47303
Course Title Additional	
Scientific-Disciplinary Sector	AGRI-04/B
Language	English
Degree Course	Master in Smart Sustainable Agriculture Systems in Mountain Areas
Other Degree Courses (Loaned)	
Lecturers	Dr. Pasqualina Gloria Sacco, PasqualinaGloria.Sacco@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/48345 Prof. Fabrizio Mazzetto, fabrizio.mazzetto@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/29638
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	6
Teaching Hours	36
Lab Hours	24
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	The course aims to provide students with the basic knowledge and strategies to introduce digitization solutions in agricultural farm processes. First of all, the concept of Smart Agriculture will be defined, as a management strategy that uses information technologies to collect data from multiple sources in view of their subsequent use in the context of decisions concerning production activities. From this, the demands for innovation in terms of the

	need to introduce farm information systems and their technological implications on the machine equipment of farms will be analyzed. The course will be articulated in the following topics: 1) Data-information transformation cycle and roles of Farm Information Systems (FIS); 2) Classification of hardware and software technology components of a FIS; 3) Technologies for environmental, crop and operational monitoring; 4) Data storage and tools for their digital processing (DBMS, GIS, CAD); 5) Tools for data evaluation (diagnostics, prescriptive functions, multi-criteria evaluations); 6) Technologies for automation and traceability of processes, and their related impacts on agricultural machinery; 7) Prospects for advanced automation, robotization and their integration functions in a FIS; 8) Advantages and limits in the use of artificial intelligence in farm processes
Course Topics	The course will be articulated in the following topics: 1) Data-information transformation cycle and roles of Farm Information Systems (FIS); 2) Classification of hardware and software technology components of a FIS; 3) Technologies for environmental, crop and operational monitoring; 4) Data storage and tools for their digital processing (DBMS, GIS, CAD); 5) Tools for data evaluation (diagnostics, prescriptive functions, multi-criteria evaluations); 6) Technologies for automation and traceability of processes, and their related impacts on agricultural machinery; 7) Prospects for advanced automation, robotization and their integration functions in a FIS; 8) Advantages and limits in the use of artificial intelligence in farm processes
Keywords	Precision Agriculture Farm Information Systems

	Sensors Identification Systems Positioning Systems Database Management Systems Decision Support Systems
Recommended Prerequisites	Basic knowledge on Farm Mechanisation, Farm Processes and Management, Computer Sciences
Propaedeutic Courses	No
Teaching Format	Frontal lectures (36 hours), exercises (12 hours, including an external excursion), labs (8 hours), office (18).
Mandatory Attendance	No
Specific Educational Objectives and Learning Outcomes	Knowledge and Understanding --> - Use the most modern and intelligent technologies and information systems for practical application and for managing and developing business processes - Actively participate in research projects in the field of mountain agriculture - Apply technical and economic standards in the design and implementation of mechanization systems and equipment for mountain farms - Collaborate with other professionals in the fields of architecture, engineering, and natural sciences - Work in interdisciplinary, national and international teams Ability to apply knowledge and understanding --> Graduates of the Master's degree program (Master SAM) are equipped with a solid scientific and technical foundation that enables them to address and solve complex problems. Thanks to their scientific and technical training in agriculture, economics, and management, graduates are able to develop analyses and plans for the development and management of agricultural businesses in mountainous regions, taking into account their specificity and multifunctionality (ecosystem services). In these specialized fields, graduates are able to coordinate interdisciplinary groups in the agricultural sector. The ability to apply acquired specialized knowledge is achieved through critical reflection on the course materials and classroom learning activities, complemented by case study analysis and practical exercises conducted by instructors. Furthermore, practical

	exercises in the laboratory, computer, and field are included, as well as field trips, literature research, the development of individual and/or group projects, and the preparation of the final thesis. The assessment of success (oral and written exams, seminar reports) and the exercises are designed in such a way that graduates must demonstrate mastery of the work tools, the methods learned, and a critical and independent way of working. Autonomy of judgement --> - choose the best production techniques while taking environmental protection into account; - analyze data and information to independently assess the quality and effectiveness of results obtained when designing strategies to manage difficulties. - make independent decisions on professional issues. These may specifically concern the feasibility of agricultural projects. - evaluate quality assurance systems for agricultural products, including those in the tourism sector, and the methods for defining internal and external quality criteria. - plan activities and strategies based on predefined objectives, taking into account timeframes and methods. Communication Skills --> Graduates will be able to work professionally in one or more foreign languages. Mandatory courses and elective courses are taught in English. Additionally, some elective courses may be offered in Italian or German. In accordance with unibz's trilingualism policy, the unibz Language Centre offers the opportunity to take extracurricular courses (levels A1-C1) in Italian and German. Graduates will be able to communicate fluently with other professional groups they work with and will be able to participate in European projects with foreign partners thanks to the international focus of the Master's program. Written and oral communication skills are promoted through seminars, excursions, exercises, and teaching activities, which include the preparation of reports and written documents and their oral presentation in English and, where appropriate, in Italian and German in elective subjects. The aforementioned communication skills are also acquired and assessed/verified through the writing of the final

	thesis and its defense in English. The master's degree program also promotes the acquisition of additional language skills in German and Italian. This should enable graduates to successfully enter the international job market (e.g., Austria-Switzerland-Italy-Germany). Learning Capacity --> Graduates will be able to manage complex projects thanks to the specialized knowledge acquired during their studies. They will be able to continuously expand and update the specialized knowledge acquired during their studies. They will learn to use the most modern methods to competently perform analyses, project planning, and management measures in their professional lives. Graduates will be able to use various information systems to further their cultural and professional development. They will also be able to choose the methods and training paths best suited to their cultural and professional development. Graduates will be able to manage complex projects thanks to the specialized knowledge acquired during their studies. They will be able to continuously expand and update the specialized knowledge acquired during their studies. They will learn to use the most modern methods to competently perform analyses, project planning, and management measures in their professional lives. Graduates will be able to use various information systems to further their cultural and professional development. They will also be able to choose the methods and training paths best suited to their cultural and professional development. Learning skills are encouraged throughout the degree program. Special emphasis is placed on individual study, especially in completing group work on proposed topics. This skill is enhanced during compulsory lectures, which include group work, and subsequently in the preparation of the final thesis. Learning progress is assessed regularly throughout the courses and during the preparation of the final thesis. Specifically, this practice-oriented program involves working in small groups (3-5 students) on a shared project (e.g., a plan for the development of agricultural businesses in mountain areas), from the initial stages (development of objectives and measures, collection of available data) to cooperation with various stakeholders (e.g., public administration, mountain agriculture advisory center, farmers'

	association), which also includes communication activities for agriculture and society. The projects are carried out under the supervision of two or more professors, with exchanges between students and the private companies and/or public authorities involved. Learning skills are assessed through continuous assessment during the learning units and in the preparation of the final thesis.
Specific Educational Objectives and Learning Outcomes (additional info.)	Knowledge and understanding of: (1) digitization strategies for mountain farming systems, with insights on electronics, computer science, telecommunication, farm management and information systems; (2) integration smart farming technologies into farm machines and within an enterprise information systems to support mountain farmers in their operational, management and strategic decisions, (3) convenience of adopting automation or robotisation solutions in the management of specific agricultural processes. Applying knowledge and understanding in the planning, selection and use of different categories of IT solutions at farm level, with a special foucus on the constraints of resosurces tipical of mountain regions; capability of performing autonomous evaluations on selection/use of digitral farm solutions in various environmental and production contexts. Capability of presenting such an evaluation in a written report. Communication skills to present topics and issues relative to any digital smart farming system (with a foscus for mountain areas) with pertinent and adequate technical terminology. Learning skills to deepen and update the knowledge acquired during the course seeking relevant information on scientific and technical literature
Assessment	The assessment of students' outcomes will be carried out through: i) the preparation of a written report related to a specifi case study to be previously agreed with the teacher; such a report will be integrated by a ppt presentation, that will be discussed in front of the exam commission; ii) an interview on some points treated during the frontal lectures, the exercises and the lab activities. For the preparation of the written report, students may work individually or in pairs. In the latter case, each student must in any case: i) prepare his/her own ppt presentation; ii) take his/her own

	oral test individually. It will not be possible to pass the exam if one of the above assessments is not sufficient.
Evaluation Criteria	The final mark will be assigned according to the following criteria: a) completeness, clarity of the objectives and pertinent methodology and terminology used during the presentation of the report (40%); b) correctness and clarity of answers, mastery of the technical language, capability to establish relationships between different topics. (60%).
Required Readings	Didactic material made available by the lecturer.
Supplementary Readings	For consultation purposes; in alphabetical order on the title: • Chen G., *Advances in Agricultural Machinery and Technologies*. CRC Press, 2018, ISBN 978-1498754125 • Megh R. Goyal, *Emerging Technologies in Agricultural Engineering*, 1st Edition, Apple Academic Press, 2017, ISBN 978-1771883405 • Lazzari M., Mazzetto F., *Meccanica e Meccanizzazione dei Processi Produttivi Agricoli*. Reda Ed., 2016, ISBN 978-8883612558 (in Italian) . AAVV - Agricoltura di precisione. Metodi e tecnologie per migliorare l'efficienza e la sostenibilità dei sistemi colturali. Edagricole Ed. 2024, ISBN **978-88-506-5669-1** (in Italian)
Further Information	//
Sustainable Development Goals (SDGs)	Zero hunger, Good health and well-being, Quality education, Clean water and sanitation, Life on land, Decent work and economic growth, Responsible consumption and production, Climate action, Affordable and clean energy