Syllabus

Course Description

Course Title	Hydrology and Hydraulics
Course Code	40196
Course Title Additional	
Scientific-Disciplinary Sector	AGRI-04/A
Language	Italian
Degree Course	Bachelor in Agricultural, Food and Mountain Environmental Sciences
Other Degree Courses (Loaned)	
Lecturers	Prof. Michele Larcher, Michele.Larcher@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33885 Prof. Andrea Andreoli, Andrea.Andreoli@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35911
Teaching Assistant	
Semester	First semester
Course Year/s	3
CP	9
Teaching Hours	60
Lab Hours	30
Individual Study Hours	135
Planned Office Hours	18
Contents Summary	The course is part of the group of topics characterizing the area skills in Agricultural Production and Forestry and Mountain Environment Management of the Agricultural, Food and Mountain Environmental Sciences degree. The "Hydrology and Hydraulics" course aims at giving the students

	the necessary knowledge to: determine a hydrological balance at a basin and stretch scale, calculate the flow rates in a small agricultural or mountain basin, design stable and efficient irrigation channels and drainages, design simple irrigation systems, design check dams for mountain environment. It is designed for acquiring professional skills and knowledge.
Course Topics	The course will cover the following topics: 1. Hydrological cycle and water budget; 2. Watershed and hydrographic network; 3. Precipitation: measurement, spatial analysis, and extreme values analysis; 4. Water in the soil water (infiltration, saturated and unsaturated conditions); 5. Surface runoff: types and characteristics, Horton and Dunne mechanism; 6. Rainfall-runoff models (Rational Method and SCS Method); 7. Hydrographs and duration curves; 8. Principles of hydrostatics (Pascal's and Stevin's Laws) and their application; 9. Fundamental equations of hydrodynamics (continuity, energy conservation, momentum conservation) and their application to orifices, weirs, and head losses; 10. Uniform flow in open channels (Manning's equation, shear stress, structural stability); 11. Uniform flow in pipes (Darcy-Weisbach equation, Moody diagram, localized head losses); 12. Land reclamation and channel design; 13. Design of pressurized irrigation systems; 14. Frost protection irrigation; 15. Erosion and sediment transport in watersheds and streams; 16. Forest Watershed protection and management.
Keywords	Hydrological cycle, rainfal-runoff models, Hydraulics, Irrigation, Forest Watershed protection and management
Recommended Prerequisites	Students are expected to have adequate knowledge of Physics, Mathematics, and Statistics in order to successfully follow the course. Knowledge of basic Topography, digital cartography, and the use of GIS software is also highly recommended, as it is useful for the spatial analysis of hydrological data and for understanding watershed dynamics.

Propaedeutic Courses	no
Teaching Format	In this course, theoretical concepts are presented in class by the professor, while practical activities (laboratory sessions and field trips) are led by the professor in collaboration with the teaching assistant (TA). Students are expected to work independently in the laboratory—under the supervision of the professor and the TA—and at home, to solve exercises and prepare a report based on the lab sessions and field trip. The PowerPoint presentations used in class will be made available on the course's Microsoft TEAMS platform, along with links to external resources and exercises.
Mandatory Attendance	no
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding (1) of water dynamics in rural environments related to flood protection as well as agricultural production, (2) of the different technical solutions that can be used for the measurement, control, planning and management of torrent control works and irrigation system. Applying knowledge and understanding through the development of some skills concerning: (1) the analysis of water budget and flood discharge in small catchments, the design of stable channels (for drainage or irrigation) and irrigation systems, (2) the ability to obtain information from classwork-exercises on how integrating together the theoretical elements provided during the lessons. Making judgements concerning: (1) the choice of the most appropriate parameters for the hydrological analysis presented in a written report and in the written exercises. Communication skills to present the learned concepts (topics and issues related to agricultural and forest hydrology, hydraulic, irrigation systems and torrent control works) with a personal vocabulary that is precise, appropriate and adequate to the subject. Learning skills of increasing the personal knowledge acquired during the course by reading technical documents and scientific articles and/or attending specific courses.

Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	The student assessment will be based on: • An individual report on field and laboratory activities (20%); • An oral exam covering the entire program and including two exercises (80%).
Evaluation Criteria	The final grade for the course will be assigned as follows: Individual report on laboratory activities and field trip (20%), Oral exam covering the entire program and including two exercises (80%) Grading criteria: • Accuracy of answers (general requirement) • For open-ended questions, the following aspects will also be evaluated: clarity of responses, command of technical language, ability to summarize and establish reletionshipsbetween different topics, and relevance of the content to the question.
Required Readings	Lecture notes/slides
Supplementary Readings	• Ferro V., Elementi di idraulica e idrologia per le scienze agrarie, ambientali e forestali, Mc-Graw Hill, 2013; • Ferro V., Opere di sistemazione idraulico-forestale (indirizzo "Gestione dell'ambiente forestale montano"), Mc-Graw Hill, 2019; • Capra A., Scicolone B., Progettazione e gestione degli impianti di irrigazione, (indirizzo "Produzioni sostenibili agrarie"), Edagricole, 2° ed., 2016 • Benini G., Sistemazioni idraulico-forestali, (indirizzo "Gestione dell'ambiente forestale montano"), UTET, Torino, 2000 • Dingman S.L., Physical hydrology, Waveland press, 2008 • Nalluri C., Featherston R.R., Civil Engineering Hydraulics, Blackwell Science, 2001
Further Information	During the course, the open-source software QGIS will be used for the hydrological modeling of the watershed
Sustainable Development Goals (SDGs)	No poverty, Clean water and sanitation, Affordable and clean energy, Life on land, Sustainable cities and communities, Responsible consumption and production, Climate action, Industry, innovation and infrastructure