Syllabus

Course Description

Course Title	Mountain hydrology and risk processes
Course Code	47069
Course Title Additional	
Scientific-Disciplinary Sector	
Language	English
Degree Course	Master in Environmental Management of Mountain Areas
Other Degree Courses (Loaned)	
Lecturers	Prof. Maurizio Righetti, Maurizio.Righetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740 Prof. Michele Larcher, Michele.Larcher@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33885
Teaching Assistant	
Semester	First semester
Course Year/s	1
CP	6
Teaching Hours	40
Lab Hours	20
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	- Introduction to natural risks in mountain areas - Basics of river hydraulics - Initiation of sediment motion and basics of sediment transport - Hillslope processes - Debris flows - Definition of hazard, vulnerability and risk - Overview of modelling tools for natural hazards prediction

	- Hints of structural and non-structural mitigation measures - Flood hydrology and statistics of extreme events: concepts and models - Prediction of large wood and bedload transport during floods - Prediction of geomorphic changes during floods - Design of river management structures in mountain torrents - Design of river management structures in lowland rivers - Integrated river management interventions - Fundamental of river hydraulics: stationary motion in free surface flows, theory ad practice
Course Topics	The course, devoted to mountain hydrology and risk processes, is organized into two modules: (i) Natural Risks in Mountain Areas: Processes and Mitigation Strategies; and (ii) Experimental River Hydraulics. The first module introduces fundamental topics, with particular emphasis on the definition and identification of natural risks in mountain environments, the concepts of hazard, vulnerability, and risk, as well as the fundamentals of river hydraulics in mountain areas. Field excursions and GIS-based activities will further consolidate the theoretical knowledge. The second module provides an in-depth examination of river hydraulics and sediment transport, together with management structures and mitigation measures. Laboratory experiments and group projects carried out by the students will serve to integrate and apply the theoretical concepts addressed.
Keywords	Natural risk, natural hazard, river hydraulics, hydrology, mountain environment
Recommended Prerequisites	Students are expected to have a basic knowledge of mathematics, physics, and hydraulics.
Propaedeutic Courses	No
Teaching Format	In both modules, theoretical concepts will be presented in class by the professor. The first module will be complemented by field excursions and practical activities, whereas the second module will be enriched with laboratory work. Teaching resources and supplementary materials will be made available through Microsoft Teams.
Mandatory Attendance	No
Specific Educational	Knowledge and understanding -->

Objectives and Learning Outcomes	- collaborate with other professionals in the fields of architecture, engineering and natural sciences Ability to apply knowledge and understanding --> In addition to having acquired a solid scientific-technological basis, the graduate of the Master's degree in "Environmental Management of Mountain Areas" acquires the ability to tackle and solve new problems. Thanks to a technical-scientific education, integrated with technological-managerial subjects, he or she is able to analyse, design, plan and manage the mountain territory and its specificities, vulnerabilities and characteristics. The graduate must also be able to coordinate interdisciplinary teams in the fields of ecology, restoration and functional maintenance of mountain ecosystems, agro-forestry management and socio-economic development. The tests (written and oral examinations, reports) and exercises involve the performance of specific tasks in which the student demonstrates mastery of tools, methodologies and critical autonomy. Autonomy of judgement --> The didactic approach envisages that theoretical training in courses is accompanied by individual and group work that encourages active participation, a proactive attitude and the capacity for autonomous elaboration. Communication skills --> Graduates will be able to work professionally and scientifically in one or more foreign languages, since in addition to English (the official language of the course) in which all compulsory and part of the optional courses are offered, they will be able to follow optional courses offered in Italian or German. The Language Centre of the Free University of Bozen/Bolzano also offers students, in accordance with the policy for trilingualism that characterises the profile of the Free University of Bozen/Bolzano, the possibility of taking extracurricular courses at level (A1-C1) in Italian and German. Finally, the graduate will be able to effectively communicate what he or she has learnt to the different professional categories with which he or she works and has the ability, given the international

	nature of the degree course, to share projects with foreign interlocutors. Written and oral communication skills are developed in seminars, tutorials and training activities, which also include the preparation of written reports and documents and the oral presentation of these, compulsorily in English and possibly in Italian and German for optional courses. The acquisition and assessment/verification of the achievement of communication skills is also envisaged through the writing of the final dissertation and its discussion in English. The Master's degree course promotes the acquisition of additional language skills (Italian/German), which are also aimed at increasing the ability of graduates to effectively market themselves on the labour market in part of the Alpine region (Austria-Switzerland-Italy-Germany). Learning capacity --> The graduate will have the ability to learn by synthesising the notions learnt in the course of studies, in order to address complex design issues, by expanding and updating the knowledge and technical skills acquired by using analysis, design and management tools appropriate to the situations in which the graduate operates. The graduate will be able to manage the different information networks in order to be able to continue to learn and thus to update himself/herself for his/her own cultural improvement and professional advancement. In addition, the graduate will be able to identify the appropriate training tools and paths for the development of their own cultural and specialist knowledge. Learning skills are attained during all phases of the course of study. The Master's degree course enables students to consolidate their self-study skills, especially when they carry out group work on proposed topics; again, this ability is enhanced during a compulsory course, which involves group work, and subsequently in the preparation of the final thesis of an experimental nature. In particular, this practical course requires students to work in small groups (3-5) on a project (e.g., rural development plan for a mountainous area, rehabilitation project for a degraded terrestrial or river ecosystem) from its initial stages (identification of objectives, conceptual development of actions, collection of available data) through to interaction with the various stakeholders and communication activities towards society. The projects will

	take place under the supervision of two or more professors from the two universities involved, but also by having the students interact with professional firms and/or public technical offices that have already expressed interest and willingness to do so. Learning ability is assessed through continuous forms of verification during the training activities and during the conduct of the activity related to the final examination.
Specific Educational Objectives and Learning Outcomes (additional info.)	Knowledge and understanding of: i) basics of mountain river hydraulics and sediment transport; ii) main geomorphological processes typical of mountain areas iii) identifying natural hazards and related risks in mountain areas; iv) pros and cons of possible management strategies. Applying knowledge and understanding to the analysis of hazard scenarios in mountain environments and the identification of possible risk mitigation measures. Making judgements on types and magnitude of natural hazards and management options through the personal interpretation of the study areas. Communication skills to present basic and applied aspects of fluvial and colluvial processes in mountain areas and of management strategies to stakeholders, scientists, and the public clearly and unambiguously with pertinent and adequate technical terminology. Learning skills to autonomously deepen and update the knowledge acquired during the course seeking relevant information on scientific and technical literature, for their future professional and/or academic studies.
Assessment	The assessment will be performed independently for the two modules. The assessment of students' outcomes will be carried out through i) oral exam on the contents of the course and ii) individual written report.
Evaluation Criteria	The mark will be assigned based on the exam (80 %) and on an individual report (20 %). Relevant for assessment of student reports: ability to use correct technical terminology, to perform the analysis of natural risks and possible mitigation strategies and to apply a critical thinking.

	Relevant for the written exam assessment are correctness and clarity of answers, mastery of the technical language, capability to establish relationships between different topics.
Required Readings	· Teaching material and scientific papers provided in class.
Supplementary Readings	· A. Armanini (2018) Principles of river hydraulics. Springer (selected chapters). · P. L. Bierman and D. R. Montgomery (2013) Key concepts in Geomorphology. Macmillan learning (selected chapters) · Additional scientific papers provided in class
Further Information	
Sustainable Development Goals (SDGs)	Quality education, Life on land, Climate action

Course Module

Course Constituent Title	Natural risk in mountain areas: processes and mitigation strategies
Course Code	47069A
Scientific-Disciplinary Sector	AGRI-04/A
Language	English
Lecturers	Prof. Michele Larcher, Michele.Larcher@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33885
Teaching Assistant	
Semester	First semester
CP	3
Responsible Lecturer	
Teaching Hours	20
Lab Hours	10
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	- Introduction to natural risks in mountain areas - Basics of river hydraulics - Initiation of sediment motion and basics of sediment transport

	- Hillslope processes - Debris flows - Definition of hazard, vulnerability and risk - Overview of modelling tools for natural hazards prediction - Hints of structural and non-structural mitigation measures
Course Topics	The first module of the course focuses on natural risks in mountain areas and introduces fundamental topics, with particular emphasis on the definition and identification of such risks, the concepts of hazard, vulnerability, and risk, as well as the fundamentals of river hydraulics in mountain environments. Field excursions and GIS-based activities performed by the students will further consolidate the theoretical knowledge.
Teaching Format	Theoretical concepts are presented in the class by the professor and field excursions are led by the professor with the teaching assistant. Teaching material and the transcription of the blackboard will be made available in MS Teams. Additional material will be provided on selected topics.
Required Readings	· Teaching material and scientific papers provided in class.
Supplementary Readings	· A. Armanini (2018) Principles of river hydraulics. Springer (selected chapters). · P. L. Bierman and D. R. Montgomery (2013) Key concepts in Geomorphology. Macmillan learning (selected chapters). · Additional scientific papers provided in class.

Course Module

Course Constituent Title	Experimental river hydraulics
Course Code	47069B
Scientific-Disciplinary Sector	CEAR-01/B
Language	English
Lecturers	Prof. Maurizio Righetti, Maurizio.Righetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740
Teaching Assistant	

Semester	First semester
CP	3
Responsible Lecturer	
Teaching Hours	20
Lab Hours	10
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	- Laboratory experiments on stationary free surface flows - Hydraulic measurements in rivers, laboratory and field measurement techniques/methods
Course Topics	Free surface flow hydraulics, energy and momentum balance, free surface flow and singularities in rivers, narrowing, steps, spillways. Laboratory Experiments on free surface flows. Measurement instruments for water flows: velocity measurements, level/pressure measurements, discharge measurements.
Teaching Format	Theoretical concepts are presented in the class by the professor. Laboratory experiments and group projects carried out by the students will serve to integrate and apply the theoretical concepts addressed.
Required Readings	Teaching material and scientific papers provided in class.
Supplementary Readings	