UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

SNOW AVALANCHES AND RELATED MOUNTAIN NATURAL HAZARDS

Anno immatricolazione	2019/2020
Anno offerta	2019/2020
Normativa	DM270
SSD	ICAR/02 (COSTRUZIONI IDRAULICHE E MARITTIME E IDROLOGIA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA CIVILE E ARCHITETTURA
Corso di studio	CIVIL ENGINEERING FOR MITIGATION OF RISK FROM NATURAL HAZARDS
Curriculum	Hydrogeological risk assessment and mitigation
Anno di corso	1°
Periodo didattico	Secondo Semestre (02/03/2020 - 24/03/2020)
Crediti	6
Ore	51 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO
Docente	BARBOLINI MASSIMILIANO (titolare) - 3 CFU PASIAN MARCO - 3 CFU
Prerequisiti	Basic knowledge of statistic, mathematics, and physics for engineers. Passion for mountain and related natural hazard
Obiettivi formativi	Mountains occupy about 20% of the land, and approximately 10% of the Earth's population live in mountains. Great differences in altitude and significant energy potential due to gravity, along with the important role of water in both liquid and solid phases, means that natural hazards of gravitational type are common phenomena in mountains and significantly affect lives and good of people living there. The goal of the course is to introduce the student to the phenomenology and specific features of the considered processes (namely snow avalanches, rock fall and rock avalanches, debris avalanches) as well as to key concept of general validity related to hazard estimate and risk mitigation. At the end of the course the student should: (a) be able to classify the

	processes, either on the base of phenomenological features or size; (b) properly handle general concept of risk estimate and mitigation; (c) have basic insight on modelling of considered processes; (d) be able to perform a preliminary design of structural work to reduce hazard and vulnerability; (e) be able to properly and effectively apply a set of empirical relationship and expert criteria for engineering practice.
Programma e contenuti	1. Snow cover formation and stability Introduction and motivations; Snow cover formation; Metamorphisms; Snowpack stratigraphy; Snow cover stability; Release mechanisms; Snowpack profiling; Stability tests; Avalanche classification; Identification of avalanche paths; 2. Snow Avalanches Statistical avalanche modelling; Avalanche return period: definition and estimate based on historical data; Avalanche encounter probability; Avalanche dynamics models: definition of the design event; Estimate of avalanche velocity and run-out distance using centre of mass models; Estimate of avalanche forces against obstacles; Example of avalanche calculation based on real world cases; Outline of risk mitigation strategies; Outline of structural avalanche defence works; Design criteria for active avalanche defence structures; Design criteria for passive avalanche defence structures; Example of design of avalanche active/passive protective works based on real world cases 3. Rockfall and Rock avalanches Rock avalanche and rock falls: definitions; UNI 11211 Italian design code for rock fall protective measures; Design criteria for rock fall barrier and anchoring systems; Design criteria for rock fall embankments; Active vs passive rock fall defence works: real world examples 4. Debris flow and debris avalanches Susceptibility of a mountain basin to debris flow formation; Empirical relationship for debris flow: calculation of magnitude, peak flow rate, velocity, run-out distance; Design criteria for passive structure against debris flow: flexible vs rigid barrier; Passive debris flow defence works: real world examples.
Metodi didattici	Lectures (hours/year in lecture theatre): 36 Practical class (hours/year in lecture theatre): 15 Practicals / Workshops (hours/year in lecture theatre): 0
Testi di riferimento	The avalanche Handbook, D. McClung & P. Schaerer, Ed. The Mountaineers The Technical Avalanche Protection Handbook, Wiley Eds (Ernst & Sohn) UNI 11211-4 – Rockfall protective measures, Part 4 – Definitive and executive design Dieter Rickenmann, Empirical Relationships for Debris Flows, Natural

	Hazards 19: 47–77, 1999
Modalità verifica apprendimento	Written exam
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile