UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

FLUVIAL HYDRAULICS

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	ICAR/01 (HYDRAULICS)
Department	DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE
Course	CIVIL ENGINEERING
Curriculum	Idraulico
Year of study	2°
Period	1st semester (27/09/2021 - 21/01/2022)
ECTS	6
Lesson hours	51 lesson hours
Language	English
Activity type	ORAL TEST
Teacher	GHILARDI PAOLO (titolare) - 3 ECTS FENOCCHI ANDREA - 3 ECTS
Prerequisites	Basic knowledge of hydraulics or fluid mechanics. A basic knowledge of GIS software would be beneficial.
Learning outcomes	Students will learn the basics of hydraulics of natural streams, solid transport mechanics and related hydrodynamic processes, and how to deal with the one-dimensional modelling of an extended fluvial reach using the HEC-RAS and QGIS softwares.
Course contents	1. Basics of Natural Streams Hydrodynamics – Momentum and Energy equations, Turbulence and Velocity Distribution in Natural Streams Flows, Velocity and Bed Shear Stress Distribution. 2. Solid Transport Threshold – Hydrodynamic Drag and Lift on a Solid Grain, Threshold Velocity, Threshold Bed Shear Stress, Probabilistic Concept of Entrainment, Threshold of Nonuniform Sediment Motion. 3. Bed-Load Transport – Empirical Relationships Involving Bed Shear

	Stress, Discharge or Velocity; Probabilistic and Deterministic Concepts; Fractional Bed Load of Nonuniform Sediments. 4. Suspended-Load Transport – Diffusion Concept: Equation for Vertical Distribution of Sediment Concentration, Nonequilibrium Sediment Concentration Distribution, Suspended Load. Threshold Condition for Sediment Suspension. Wash Load. 5. Total-Load Transport – Direct and Indirect Method. Total-Load Transport of Nonuniform Sediments. 6. Bedforms – Ripples, Dunes, Antidunes, Chutes and Pools, Bars. Models for Prediction of Bedforms. Resistance to Flow Due to Bedforms: Methods for Stress Partitioning. 7. Numerical modeling of flow in rivers: Geometry preparation, initial and boundary conditions setting, steady- and unsteady-flow simulations, sensitivity analyses on the adopted parameters, preparation of a technical report.
Teaching methods	Lectures with slides and multimedia projection, focused on the physical processes of fluvial hydrodynamics; numerical exercises in computer room interrupted by several theoretical explanations to justify what is done and how to extend it to other cases
Reccomended or required readings	• Dey, S., Fluvial Hydrodynamics: Hydrodynamic and Sediment Transport Phenomena, Springer-Verlag, 2014 • Garcia, M., (ed.), Sedimentation Engineering: Processes, Measurements, Modeling, and Practice, Asce Manual and Reports on Engineering Practice No. 110 • Armanini, A., Principles of River Hydraulics, Springer, 2017 • HEC-RAS Manuals (public domain) • Course notes, scientific papers and other material will be provided during the course.
Assessment methods	Oral exam. The students should deliver before the exam a technical report of the case study dealt with during the exercises and should be able to discuss it in depth at the oral examination
Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile