UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

CONTINUUM MECHANICS

Enrollment year	2018/2019
Academic year	2018/2019
Regulations	DM270
Academic discipline	ICAR/01 (HYDRAULICS)
Department	DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE
Course	CIVIL ENGINEERING FOR MITIGATION OF RISK FROM NATURAL HAZARDS
Curriculum	Hydrogeological risk assessment and mitigation
Year of study	1°
Period	1st semester (24/09/2018 - 17/10/2018)
ECTS	6
Lesson hours	51 lesson hours
Language	English
Activity type	WRITTEN AND ORAL TEST
Teacher	MANENTI SAURO (titolare) - 6 ECTS
Prerequisites	Basics of vector, matrix and tensor algebra. Mathematical foundations. Integral theorems (Stokes and Gauss).
Learning outcomes	To provide the foundamental theoretical concepts and mathematical tools for the analysis of relevant problems in the hydraulic engineering field.
Course contents	Review of mathematical foundations: vector and tensor algebra; coordinate systems; Stokes theorem and Gauss theorem. Analysis of stress: the continuum concept; Cauchy stress principle; stress tensor; principal stress; Mohr circles; deviator and spherical stress tensor.

	Deformation and strain: Lagrangian and Eulerian descriprion; small deformation theory; strain tensor; principal strains; spherical and deviator strain tensor; plane strain; compatibility equations; velocity gradient tensor; rate of deformation tensor; vorticity tensor. Foundamental laws of continuum mechanics: mass conservation - continuity equation; Reynolds transport theorem; linear momentum conservation; angular momentum conservation; energy conservation. Constitutive equations: Newtonian fluid. Governing equations of fluid mechanics: Navier-Stokes equations. Special cases: perfect fluid; Euler and Bernoulli equations. Laplace equation. Kelvin theorem. Viscosity and applications to engineering problems: Viscosity of Newtonian fluids. Flow curve. Common non-Newtonian rheological models. Experimental measurement of fluid viscosity. Rheological characterization of sludge from Termophilic Aerated Membrane Reactor for wastewatertreatment. CFD modelling of passive energy dissipation system: the case of annular viscous fluid damper. Numerical solution of the fundamental equations of fluid mechanics and engineering applications: basics of Smoothed Particle Hydrodynamics (SPH) method. Discretized governing equations. SPH modelling of landslide generated wave in artificial reservoir. Vawe impact against rigid body.
Teaching methods	=
Reccomended or required readings	R. Aris "Vectors, tensors, and the basic equations of fluid mechanics" Dover pub. W. Prager "Introduction to mechanics of continua" Ginn and Co. 1961 P.C. Chou & N.J. Pagano "Elasticity, tensor, dyadic, and engineering approaches" Dover pub. Wilkinson W.L., Non-Newtonian fluids. 1960 Pergamon Press. Liu, G-R. and Liu, M.B. Smoothed Particle Hydrodynamics: a meshfree particle method. World Scientic, 2003.
Assessment methods	The final examination will consist of an essay on a course’s topic to be selected and discussed orally by the student.
Further information	Lecture notes can be downloaded from the course page on the platform KIRO (https://elearning2.unipv.it/ingegneria/)
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile