UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

GEOTECHNICAL EARTHQUAKE ENGINEERING

Anno immatricolazione	2019/2020
Anno offerta	2019/2020
Normativa	DM270
SSD	ICAR/07 (GEOTECNICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA CIVILE E ARCHITETTURA
Corso di studio	CIVIL ENGINEERING FOR MITIGATION OF RISK FROM NATURAL HAZARDS
Curriculum	Reduction of seismic risk
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	LAI CARLO GIOVANNI (titolare) - 6 CFU
Prerequisiti	Basics of Geotechnical Engineering and Mechanics of Deformable Body.
Obiettivi formativi	Scope of the course is to introduce students to the basic theories and methods of soil dynamics and earthquake geotechnical engineering. Topics covered include wave propagation, ground response analyses, phenomena of ground failure like soil liquefaction, seismic instability of slopes, surface fault rupture. The course consists of lectures to illustrate the theory and tutorial sessions where the emphasis is on applications and problem solving. Each subject is illustrated with the support of experimental and observational evidences, mathematical modeling and well-documented case histories from major earthquakes worldwide drawn from the experience of the instructor.
Programma e contenuti	Review of seismic hazard, risk, vulnerability and exposure. Macro- and micro- zonation of a territory. Ground motion intensity measures. Fourier

	analysis and response spectra. Signal processing of earthquake records. FFT algorithm, aliasing and Nyquist criterion. Spectrograms. Introduction to seismometry. Analog and digital instruments, strong-motion accelerometric datasets. Basic concepts of elastodynamics. P and S waves, stationary oscillations. Propagation of elastic waves in heterogeneous continua. Fermat's principle and Snell's law. Zoeppritz equations. Rayleigh and Love surface waves. Introduction to Biot's theory and Gassmann equations. Ground response analyses. Concept of transfer function. Material damping. Examples of ground amplification. Linear and linear-equivalent ground response analyses. Introduction to fully non-linear analyses. CFL stability condition and grid dispersion. Topographic amplification. Basin effects. Site characterization. Experimental measurement of dynamic properties of soils. Geophysical seismic tests. Phenomena of seismic geotechnical risk. Liquefaction and cyclic mobility. Critical state theory. Constitutive modeling of dynamic behaviour of soils. Simplified methods for the assessment of liquefaction susceptibility and ground deformation. Co-seismic and post-seismic instability of natural slopes. Pseudo-static analyses and Newmark method. Mitigation measures.
Metodi didattici	Lectures (hours/year in lecture theatre): 46 Tutoring classes (hours/year in lecture theatre): 12
Testi di riferimento	Kramer, S. (1996). Geotechnical Earthquake Engineering. Prentice-Hall, pp. 653. Reference textbook. Kokusho, T. (2017). Innovative Earthquake Soil Dynamics. CRC Press, pp. 478. Reference textbook. Ishihara, K. (1996). Soil Behaviour in Earthquake Geotechnics. Oxford Press, pp. 350. Reference monograph on soil dynamics and laboratory tests. Verruijt, A. (2010). An Introduction to Soil Dynamics. Springer-Verlag, New York, 431 pp. Reference textbook on theoretical soil dynamics. Course notes, scientific articles and other material will be provided during the course.
Modalità verifica apprendimento	Assignments will be handed over and graded during the course. The final examination will consist of a 3 hours, written test. The final-exam format is closed-book. An equation-sheet will be provided if needed. Grading: 40% assignments, 60% final exam.
Altre informazioni	Lecture notes, scientific articles and other material are posted at the KIRO web site: https://elearning2.unipv.it/ingegneria/
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile