UNIVERSITÀ DEGLI STUDI DI PALERMO

SCHOOL	POLYTECHNIC SCHOOL
ACADEMIC YEAR	2016/2017
FIRST CYCLE COURSE	CIVIL AND BUIDING ENGINEERING
SUBJECT	GEOTECHNICAL ENGINEERING
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50282-Ingegneria della sicurezza e protezione civile, ambientale e del territorio
CODE	03699
SCIENTIFIC SECTOR(S)	ICAR/07
HEAD PROFESSOR(S)	
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	03657 - APPLIED GEOLOGY 06313 - MECHANICS OF SOLIDS ANS STRUCTURES 03769 - HYDRAULICS
YEAR	3
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	

DOCENTE:

TEACHING METHODS	Lessons and exercises in class
ASSESSMENT METHODS	Oral exam following a written test. Presentation and discussion of applicative exercises developed during the course
LEARNING OUTCOMES	Knowledge and ability to grasp problems The student will learn the fundamentals of the mechanics of dry and saturated soils, namely identification and index properties; mechanical behaviour (effective stresses principle, shear strength and its components i.e. intergranular resistance, dilation, rearrangements of solid particles, deformability and displacements); seepage and consolidation processes and the associated evolution of settlements; earth pressure on retaining walls; ultimate bearing capacity of shallow foundations; difference between drained and undrained processes. Ability to apply in practice the acquired knowledge The student will learn how to solve simple practical problems such as the design and verification of shallow foundations, the stability of infinite slopes, earth retaining walls also when in the retained soil mass steady seepage processes take place. Judgement The student will acquire the ability to make sensible decisions, i.e. a) to recognize the fundamental aspects of common geotechnical problems, such as the boundary conditions of seepage and consolidation processes; b) to appraise the relevance of pore water pressures for stability problems, and the importance of the variations of effective stresses for soil deformations and displacements; c) to understand the key role of laboratory and in situ testing for the geotechnical modelling of soil response; d) to clearly distinguish drained from undrained conditions. Communication ability The student should be capable of writing clearly simple technical reports concerning the topics of the course. Learning ability The topics of the course will be dealt with taking into account theoretical, experimental and applicative aspects, and to point out the underlying methodology for the statement of the problems and the critical evaluation of results of analyses and/or experimental measurements. For this purposes theoretical results concerning outstanding case-histories will be compared with the actual behaviour of the soil-structure system.
EDUCATIONAL OBJECTIVES	Fundamental knowledge for geotechnical characterisation of the ground, for the determination of pore water pressures. Ability to calculate: initial stress state within the involved soil mass, and to select properly shear strength and deformability parameters of involved soils; acquaintance with the basic geotechnical laboratory tests; capability to determine variations of stresses within the soil mass caused by loads and excavations, in simple cases; ability to analyse simple slope stability problems, earth retaining walls, foundations; predict the evolution of settlements.
PREREQUISITES	Fundamentals of Mechanics of solids and Structures and Hydraulics
SUGGESTED BIBLIOGRAPHY	Lambe & Whitman. Meccanica dei Terreni. D. Flaccovio Ed., Palermo 2008. Contiene anche numerosi esercizi svolti. Atkinson. Geotecnica – Meccanica delle terre e fondazioni. McGraw-Hill Ed., Milano 1997.

SYLLABUS

Hrs	Frontal teaching
1	Identification of soils and rocks
2	Index properties. Classification of soils
4	Stresses within a soil mass. Effective stress principle. Stresses in the ground due to selfweight. Coefficient of earth pressure at rest and its relationships with OCR and phi'
2	Stress increases in the ground due to external loads and to excavations
2	Stress-paths
2	Shear strength of soils
1	Direct shear tests
1	Triaxial compression tests
1	Stress-strain relationships

SYLLABUS

Hrs	Frontal teaching
2	Permeability. Darcy's law
4	Seepage processes in soils and their classification according different criteria. Laplace's equation: derivation and integration, and validity. Flow net.
1	Lab e in situ permeability tests
3	Total, interstitial and effective stresses in presence of seepage. Piping
2	Earth pressures on retaining walls for drainend conditions
3	Slope stability for drainded conditions. Infinite slope stability for various types of seepage
2	Bearing capacity of strip foundations
1	Transient seepage processes
6	1-D consolidation. Derivation and integration of Terzaghi equation for 1-D consolidation process. Initial excess pore water isocrone. Evaluation of ground settlements
2	Oedometric compression test and its interpretation including the determination of overconsolidation stress
2	Intrinsic compressibilty curve
2	Immediate and consolidation settlements
1	Undrained shear strength of soils
2	Stability problems under undrained conditions
3	A preliminary outline of landslides. Delayed failure. Staged construction
3	An outline of critical state soil mechanics
3	Criteria for programming in situ geotechnical investigations
1	Laboratory soil testing. In situ measurements of interstitial pressures
1	Italian geotechnical regulations

Hrs	Practice
2	Index properties
3	Selfweight stresses in a homogeneous or horizontally stratified soil mass
3	Calculation of increase of stresses due to external loads by means of Boussinesq, Cerruti and Mindlin formulae, and of the Newmark charts
2	Direct shear tests: working out and interpretation of lab data
3	Practical use of Laplace equation to study seepage processes, and of flow nets for 1-D, and 2D conditions to find the distribution of piezometric heads, pore water pressure, flow rate, and to perform verifications against piping
2	Interpretation of the results of constant and falling head permeability tests
3	Effective stresses in the ground under hydrostatic and seepage conditions; evaluation of seepage forces
3	Active and passive earth thrust on retaining walls using Rankine theory or Coulomb method. Criteria for discriminating active state from passive state
3	Verification of slope stability of infinite slopes for various distributions of interstitial pressures
3	Calculation of the ultimate bearing capacity of strip footings including the influence od interstitial pressures
3	Calculation of excess pore water pressures and study of their evolution using the Terzaghi consolidation theory and of the associated settlements
3	Working out oedometric compression tests
3	In situ measurement of pore water pressures; response time of different piezometers