COURSE DESCRIPTION

1. GENERAL INFORMATION

SCHOOL	Civil Engineering		
DEPARTMENT			
EDUCATION LEVEL	Undergraduate		
COURSE CODE	1264	**SEMESTER**	3
COURSE TITLE	Laboratory on Constructions – Geotechnics		

COURSE UNITS *σε περίπτωση που οι διδακτικές απονέμονται σε διακριτά μέρη του μαθήματος π.χ. Διαλέξεις, Εργαστηριακές Ασκήσεις κ.λπ. Αν οι διδακτικές απονέμονται ενιαία για το σύνολο του μαθήματος αναγράψτε τις εβδομαδιαίες ώρες διδασκαλίας και το σύνολο των διδακτικών μονάδων / ECTS*	**WEEKLY HOURS**	**ECTS CREDITS**
Laboratory exercises	3	3

COURSE TYPE: *Γενικού Υποβάθρου, Ειδικού Υπόβαθρου, Ειδικότητας*	Laboratory
PREREQUISITE KNOWLEDGE:	None
COURSE AND EXAMS LANGUAGE:	Greek
COURSE OFFERED TO ERASMUS STUDENTS:	No
COURSE WEBSITE (URL):	https://helios.ntua.gr/course/view.php?id=1647

2. LEARNING OBJECTIVES

Learning Objectives

This course forms the basis of the introduction to experimental methodology, instructing students in the preparation of experimental set-ups and the metrology of physical quantities. It also introduces students to the analysis of experimental results for the identification and interpretation of the behavior of structures and geotechnical problems.

Upon successful completion of the course, students are able to:

1. know the experimental methods available to engineers in order to investigate structural behavior and geotechnical applications,
2. measure physical and mechanical properties of structural elements, structures and soils,
3. elaborate experimental data,
4. understand the phenomena that govern the actual behavior of structures and geotechnics,
5. verify the calculated experimental results based on the theoretical knowledge,
6. use synthetically the knowledge acquired from previous courses.

General abilities

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις Λήψη αποφάσεων
Αυτόνομη εργασία Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Εργασία σε διεπιστημονικό περιβάλλον
Παράγωγή νέων ερευνητικών ιδεών
Σχεδιασμός και διαχείριση έργων
Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης

- Independent work
- Exercise judgement
- Promotion of free thinking

3. COURSE DESCRIPTION

1	INTRODUCTION	Εισαγωγή στο εργαστήριο Κατασκευών και Γεωτεχνικής
2a	REINFORCED CONCRETE – SIMPLY SUPPORTED BEAM	Four-point bending of reinforced concrete beam ensuring shear failure. Exhaustion of bearing shear capacity and calculation of stresses and strains before yield. Study of the brittle (undesirable) case of failure. Determination of stiffness before yield.
2b	REINFORCED CONCRETE – SIMPLY SUPPORTED BEAM	Four-point bending of reinforced concrete beam ensuring flexural failure. Exhaustion of bearing flexural capacity and calculation of stresses and strains before yield. Study of the ductile (desirable) case of failure. Determination of stiffness after yield.
3	NON-DESTRUCTIVE TEST METHODS	Implementation of non-destructive test methods in the assessment of reinforced concrete structural elements. Use of rebound hammer and rebar detector.
4	SOIL-SAND AT VARIOUS DENSITIES	Measurement of pore water pressure in soil samples at rest and under steady-state groundwater flow. Experimental setup to induce soil liquefaction in the laboratory. Experimental setup to study Darcy's law. Measurement of the hydraulic conductivity/permeability k=(m/s) of sand at various densities. Study of flow problems in soils due to groundwater movement; soil permeability calculations. Critical hydraulic gradient introducing quick condition and piping in sandy soils compared with soil liquefaction.
5	SOIL-SAND AND RETAINING WALL	Potential collapse conditions of retaining walls. Mobilization of active and passive pressure distribution with wall translation. Simplified pressure distribution at limiting condition. Experimental setup for the study of the degree of wall soil interaction, with measurement of loads and displacements behind a retaining wall.
6	STRUCTURAL SYSTEMS	Bearing systems. Beams, frames, arches and grillages. Degrees of freedom. Dynamic base excitation with various frequencies recording of the response. Resonance curve of a single degree of freedom (SDOF) structure. Dynamic characteristics of a SDOF structure by comparing input motion and response.
7	STEEL STRUCTURES – SIMPLE STEEL BUILDING	Basic structural elements of a simple steel roofed structure. Assembling a steel building. Familiarization with basic steel elements (rolled profiles, bolts etc). Understanding og the effect of tolerances during construction and stiffness systems. Construction of steel structures and basic structural mechanics. Fundamentals of designing steel bearing systems
8	STEEL STRUCTURES – STEEL CANTILEVER	Cantilever loading. A) Closed hollow section with medium bending strength and high shear strength B) Open section (double tee) with high bending strength and low torsional strength C) Cross-sections vulnerable to lateral buckling. Appropriate cross-sections of beams under bending – torsion – lateral buckling. Behavior of beams with different cross-sections under bending and torsion.
9	SINGLE DEGREE-OF-FREEDOM SYMMETRICAL BUILDINGS (EARTHQUAKE SPECTRUM)	Uniaxial seismic testing using the shaking table. Elastic response of single degree-of-freedom structures under earthquake excitation. Natural frequency, damping, stiffness. Seismic behavior of single-story building. Definition of time history. Ground acceleration amplification at story. Relationship between absolute accelerations and relative displacements at story. Internal forces. Earthquake response spectrum.
10	SCALED MODEL OF FIVE	Uniaxial seismic testing using the shaking table. Elastic response of multiple-degrees-of-freedom subjected to earthquake. Eigenmodes. Acceleration amplification at stories.

	DEGREES-OF-FREEDOM SYMMETRICAL STEEL BUILDING	Relationship between absolute accelerations and relative displacements at stories. Internal forces.
11	SEISMIC BEHAVIOR OF BUILDING MODEL (Team Project)	Students, in groups of three, design and construct a building model, capable of bearing specified vertical loads and withstanding earthquake excitations. The models are constructed at home and then tested on the shaking table of the Laboratory for Earthquake Engineering.

4. TEACHING METHODS – STUDENT ASSESSMENT

TEACHING METHODS:	In-person at the Laboratories of the School of Civil Engineering	
TEACHING MEDIA:	Laboratory training	
COURSE ARRANGEMENT:	***ACTIVITY***	***IMPORTANCE***
	Laboratory exercises – experiments	36
	OVERALL:	**36**
STUDENT ASSESSMENT:	In-person attendance and delivery of technical report, which describes the experiment and the elaboration of experimental data. Course support and contact with students through the electronic platform https://helios.ntua.gr	

5. TEXTBOOKS – BIBLIOGRAPHY

Laboratory exercises guide