7.11 CE0730 – Foundation Engineering

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0730**	**SEMESTER**	**7**
COURSE TITLE	**Foundation Engineering**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	4
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization Course
PREREQUISITE COURSES:	Soil Mechanics (CE0540) English level B2 or higher is required for Erasmus incoming students
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (English/Erasmus)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV188/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

In this course, methods for the analysis of shallow and deep foundations are taught, in order for the student to be able to apply the criteria for their selection and to acquire the knowledge required for their design, dimensioning and check.

Upon successful completion of the course the student will be able to:

- calculate the bearing capacity and the soil index of shallow foundations.
- calculate the settlements of shallow foundations.

- apply criteria for acceptable strains and differential settlements.
- calculate foundation reactions and contact stresses which are applied in the calculation of shallow foundation reinforcement.
- calculate the bearing capacity and soil index of deep foundations.
- apply the Eurocode 7 analysis and design approach, based on the use of partial safety factors.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?;.

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Search for, analysis and synthesis of data and information, with the use of the necessary technology*
Adapting to new situations	*Adapting to new situations*
Decision-making	*Decision-making*
Working independently	*Working independently*
Team work	*Team work*
Working in an international environment	*Working in an international environment*
Working in an interdisciplinary environment	*Working in an interdisciplinary environment*
Production of new research ideas	*Production of new research ideas*

The course aims that the student acquires - practice the following general skills:

- Search for, analysis of, and synthesis of data and information, implementing appropriate technologies
- Decision-taking
- Project planning and management
- Proact free, creative and inductive thinking

(3) SYLLABUS

THEORY

1. Introduction
2. Types of foundations and supports. Basic Requirements. The concept of bearing capacity and soil index. Types of soils - elements from soil mechanics. Selection of foundation type.
3. Shallow foundations: bearing capacity of single footings. Mechanisms of failure, calculation of central vertical load, transfer of column stress to footing base, calculation of eccentric oblique loading, safety factors.
4. Shallow foundations: contact pressures, stress distribution at the footing base, stress calculation for dimensioning.
5. Surface foundation: Settlements of single footings, compression method, settlement estimation by elasticity considerations and simplified stress distribution, influence zone depth, soil index, "corrections" for settlement calculation, settlements in fine and coarse grained materials, acceptable settlements of structures.
6. Test loading plate: Bearing capacity and soil reaction index.
7. Deep foundation: Bearing capacity of single piles. Peak bearing capacity, shear friction pile strength. DIN method, method a, method b. Methods based on in-situ tests.
8. Deep foundations: Single pile settlements . Calculation of settlement - vertical soil index, horizontal soil index, settlement estimation.
9. Deep foundation: Pile group. Pile group performance. Bearing capacity and soil indices. Block and single pile failure.
10. Calculation of foundations based on Eurocode 7. Philosophy and design requirements. Partial safety factors. Comparison of EC7 and total safety factors approaches for shallow foundation analysis.

PRACTICAL EXERCISES

1. Calculation of the bearing capacity of shallow foundations and dimensioning. Calculation of the soil index.
2. Calculation of the stress distribution at the base of single and strip footings. Design of reinforcement.
3. Calculation of one-dimensional deformation settlements in sands and clays: uniform stress distribution as a function of depth.

4. Calculation of one-dimensional deformation settlements in sands and clays: reduction of stress distribution with depth (simplified method and elastic distribution)
5. Determination of the soil reaction index.
6. Calculation of bearing capacity and settlement of a single pile.
7. Calculation of bearing capacity and settlement of a pile group.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in-class teaching. When needed, distance teaching (synchronous/asynchronous)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of I.C.T. in Teaching and Student Communication
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	

Activity	*Semester workload*
In Class (/Distance) Teaching	52
Literature Study	35
Exercises / Paradigms	33
Course total	**120**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of evaluation: Greek (English/Erasmus) Written examination, 2,5-hours Problem solving, Multiple choice test, Questions and Answers, Written Essay / Project The evaluation criteria are announced to the students well before the examination; weights per subject /exercise are explicitly indicated. The examination results (including total / partial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc.

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Αναγνωστόπουλος Α.,Παπαδόπουλος Β., Σχεδιασμός των Θεμελιώσεων. Εκδόσεις Συμεών, 2014.
2. Αναγνωστόπουλος Χ., Χατζηγώγος Θ., Αναστασιάδης Α., Πιτιλάκης Δ., Θεμελιώσεις – Αντιστηρίξεις και Γεωτεχνικά Έργα. Εκδότης Χαράλαμπος Νικ. Αϊβάζης, 2012.
3. Κωμοδρόμος Μ. Αιμίλιος., Θεμελιώσεις - Αντιστηρίξεις: οριακή ισορροπία – αριθμητικές μέθοδοι, Εκδόσεις Κλειδάριθμος, Αθήνα, 2012.
4. Κωστόπουλος Σ. Δ., Γεωτεχνικές Κατασκεύες Ι. Εκδότης ΣΤΕΛΛΑ ΠΑΡΙΚΟΥ & ΣΙΑ ΟΕ, 2008.

English Bibliography:

1. Bowles, E.J. Foundation analysis and design. 5th edition, McGraw Hill, N.Y., 1996.

2. Das, M.B., Principles of foundation engineering, 4th edition, PWS Publishing, USA., 1998.
3. NAVFAC, DM-7.2. Foundations and earth structures – Design manual 7.2. Depart-ment of the Navy, Naval Facilities Engineering Command, USA., 1982.
4. Poulos, G.H., Pile foundation analysis and design. J. Wiley & Sons, N.Y., 1980.
5. Prakash, S. and Sharma, D.H., Pile foundations in engineering practice. J. Wiley & Sons, N.Y., 1990.
6. Tomlinson, M. J., Pile design and construction practice. E&FN Spon, London, 1994.
7. Tomlinson, M. J., Foundation design and practice. Longman Ltd, Singapore, 1995.