5.4 CE0540 – Soil Mechanics

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0540**	**SEMESTER**	**5**
COURSE TITLE	**Soil Mechanics**		

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**
Theory	4	4
Laboratory	-	-
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	**4**	**4**

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background Course
PREREQUISITE COURSES:	Rigid Body Mechanics (CE0120) Mechanics of Deformable Bodies (CE0220) 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/ET196/

(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*

The Soil Mechanics course aims at the comprehension of the mechanical behaviour of soil materials, as the material body on or within which the engineer designs – builds an engineering construction or as the structural material used to build the construction, and at the conprehension and the implementation of calculation tools for basic practical application problems at the soil material or construction scale. The student will realize the the

multiphase soil state and the liquid phase influence the deformability and strength, the settlement time evolution and the earth pressures.

Upon the successful accomplishment of the course the student:

- Will discern soils to fine and coarse according their grain size distribution and understand that this division influences the mechanical behaviour of soils.
- Will classify the fine grained soils according Atterberg Limits from Cassagrande and plasticity tests.
- Will be able to apply soil classification systems based on their physical characteristic of grain size distribution and plasticity.
- Will be able to analyze the stresses within soil into total stresses, effective stresses and pore water pressures.
- Will be able to calculated the geostatic stresses within the soil profile for any groundwater level.
- Will have perceived the effective stress principle for saturated soil materials.
- Will be able to apply the effective stress principle in basic soil mechanics deformation problems with special emphasis in one dimensional deformation.
- Will have perceived the phenomenon of ine dimensional deformation of soils.
- Will be able to calculate the Mohr Coulomb failure criterion cohesion and angle of shearing resistance parameters.
- Will know the difference between drained and undrained shear strength.
- Will know the difference between contractant and dilatant behaviour during shear.
- Will be able to calculate the Rankine active and passive earth pressures for non cohesive and cohesive materials.

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, analysis and synthesis of data
- Development of critical thinking
- Development of inductive thinking

(3) SYLLABUS

1. Introduction: the role of soil in technical works, continuum mechanics and soil mechanics, soil nature, prerequisite knowledge.
2. Physical properties of soils: the origin of soils, the three pahses of soils, density – porosity – water content – degree of saturation, phases relationships.
3. Physical properties of soils: soil classification based on grain size distribution, Atterberg limits – liquid and plastic limits, Casagrande plasticity chart, soil classification systems.
4. Stresses in soil mass: stress definition, plane stress Mohr's circle, total stress analysis onto pore liquid pressure and effective stress, geostatic stresses, the concept of the earth pressure at rest .
5. Soil deformation: the concepts of elasticity – yielding – hardening – failure, linear isotropic elasticity, non linear stress – strain relationship, typical loading in soil mechanics, unconfined compression – sisotropic

compression – one dimensional compression, the consolidation coefficient, the one dimensional compression – drained and undrained conditions, non linear behaviour under one dimensional deformation.
6. Soil shear strength: Mohr – Coulomb failure criterion, undrained and drained conditions, the concept of cohesion, dilatancy, loading that lead to failure: direct shear and triaxial compression.
7. Earth pressures: active and passive earth pressure, earth pressure coefficients, earth pressure diagrams for cohesive and non cohesive soils.

(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*	<table><tr><th>*Activity*</th><th>*Semester workload*</th></tr><tr><td>In Class (/Distance) Teaching</td><td>52</td></tr><tr><td>Literature Study</td><td>35</td></tr><tr><td>Exercises / Paradigms</td><td>33</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>**120**</td></tr></table>
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. Kavvadas M., Elements of Soil Mechanics. 2nd endition. Tsotras Editions, 2016. (in Greek)
2. Koletsos K., Geotechnical Engineering. University Studio Press Editions, 2004. (in Greek)
3. Papacharisis N., Grammatikopoulos I., Andreadou – Manou N., Geotechnical Engineering. Investigation-Boreholes-Laboratory. Kyriakidi Bros Publishing, 2010. (in Greek)
4. Barnes G., Soil Mechanics: Principles and Applications. Kleidarithmos Editions, 2014. (in Greek)
5. Budhu M., SOIL MECHANICS AND FOUNDATIONS. GOTSIS KON/NOS & CO, 2020. (in Greek)

Foreign Bibliography:

1. Knappett J.A. and Craig R.F., Craig's Soil Mechanics, Spon Press, 2012.
2. Lambe T. W. and Whitman R.V., Soil Mechanics, John Wiley & Sons, 1979.
3. Parry R.H.G., Mohr Circles, Stress Paths and Geotechnics, 2nd New edition, CRC Press, 2004.
4. Wood D.M., Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press, 1990

Related academic journals:

1. Acta Geotecnica, Springer
2. Geotechnique, ICE
3. Geological & Geotechnical Engineering, Springer