(B) Course information in English

General course information:

Course title:	Soil-structure interaction	**Course code:**	ΓΕ1107
Credits:	6	**Work load (hours):**	176
Course level:	Undergraduate x	Graduate	
Course type:	Mandatory x	Selective x	
Course category:	Basic	Orientation	
Semester:	10	**Hours per week:**	4

Course objectives (capabilities pursued and learning results):

Comprehension of the mechanism involved in soil structure interaction problems. Short revision and introduction to algorithms of non linear analysis, to failure criteria and surfaces and to constitutive laws. Familiarization with examples of foundations, retaining structures and infrastructures.

Prerequisites:

Mechanics I, II
Soil Mechanics I & II
Foundations & Retaining Structures
Computational Geotechnical Engineering
Structural Analysis I, II, III
Reinforced Concrete Behavior & Design

Instructor's data:

Name:	Emilios Comodromos
Level:	Professor
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Other tutors:	

Specific course information:

Week No.	Course contents	Hours	
		Course attendance	Preparation
1	Algorithms for solving non-linear systems (Newton-Rampson, substitution method).	4	
2	Short review of numerical methods (finite element, finite difference).	4	2
3	Simplified approach of soil response with linear and non linear springs, admissions, limits and application domains (application in shallow foundations).	4	2
4	Failure criteria, flow rules, constitutive laws, perfect plasticity and plasticity with hardening.	4	4
5	Definition of element stiffness matrix, assembly of global stiffness matrix, global force vector.	4	4
6	From linear or linear elasticity to a system of linear equations.	4	2
7	Simulation of actions (gravity loads, seismic action, initial stress condition). Discretisation, principles of simulating constitutive elements of a structure. Simplified and complex constitutive models, (concrete, steel, adhesion between steel-concrete). Response of cracked element under monotonic, repeated and reverse loading.	4	4
8	Methodology of a problem approach. Principles of discretisation, and simulation of representative soil-structure cases.	4	2
9	Geometrical and loading assumptions in approaching 3D problems with plane strain or axisymmetric conditions. Multistage simulation process of a problem with variable domain and boundaries.	4	4
10	Application of interaction principles in case of deep foundations under axial loading. Evaluation methods of single pile and pile group response.	4	4
11	Application of interaction principles in case of deep foundations under horizontal loading. Evaluation methods of single pile and pile group response.	4	4
12	Definition of global stiffness matrix of a pile group foundation under combined loading. Proportion of raft and piles contribution.	4	4

13	Application of interaction principles in case of the design of concrete walls. Comparison with limit equilibrium methods.	4	4
14	Application of interaction principles in case of the design of underground retaining structures. Comparison with limit equilibrium methods.	4	4

Additional hours for:			
Class project	**Examinations**	**Preparation for examinations**	**Educational visit**
60	1	15	

Suggested literature:

Bathe, K.J. and Wilson, E.L. (1976). *Numerical Methods in Finite Element Analysis*. Prentice-Hall, Englewood Cliffs, NJ.

Chen, W.F. (1982). *Plasticity in Reinforced Concrete*. McGraw-Hill Book Co., New York, N.Y., 474 pp.

Chen, W.F, & Baladi,G.Y. (1986). *Soil Plasticity- Theory and Implementation*. Elsevier Science Publishing Company, Inc. NY.

Comodromos, M.A. (2009). *Numerical methods in geomechanics – Soil-Structures Interaction*. Klidarithmos ed., Athens (in Greek).

Comodromos, M.A. (2012). *Foundations – Retaining Structures: limit equilibrium – numerical methods, ISBN 978-960-478-506-3*. Klidarithmos ed., Athens (in Greek).

Desai, C.S. and Abel, F.J. (1972). *Introduction to the Finite Element Method. A Numerical Method for Engineering Analysis*. Van Nostrand Reinhold Company - N.Y.

Desai, C.S. (1977). Soil-Structure Interaction and Simulation Problems. *In Finite Element in Geomechanics*. ed. Gudehus G., John Wiley & Sons, pp. 209-250.

Desai, C.S. & Christian, J.T. (1977). *Numerical Methods in Geotechnical Engineering*.

NAFEMS (1992). *Introduction to nonlinear finite element analysis*. Glasgow: NAFEMS (edited by E. Hinton).

Oden, J.T. (1972). *Finite Elements of Continua*. McGraw-Hill Co., N.Y.

Owen, D.R.J. & Hinton, E., (1980). *Finite Elements in Plasticity: Theory and Practice.*

Salencon, J. (1974). *Théorie de la Plasticité pour les Applications à la Mécanique des Sols*. Edit. Eyrolles, Paris.

Schofield, A.N. & Wroth, C.P. (1968). *Critical-State Soil Mechanics*. McGraw-Hill Book Co., London.

Smith, I. M. & Griffiths, D. V. (1988). *Programming the finite element method*. 2nd edition, New York, John Wiley & sons Ltd.

Zienkiewicz, O.C., (1977). *The Finite Element Method*. 3rd Edition, McGraw-Hill Book Co., New York.

Teaching method *(select and describe if necessary* - **weight***):*		
Teaching	þ	50%
Seminars	þ	10%
Demonstrations	þ	10%
Laboratory	--	……….%
Exercises	þ	30%
Visits at facilities	--	……….%
Other *(describe):* ……………………….	--	……….%
Total		100%

Evaluation method *(select)* - **weight:**				
	written	*%*	*Oral*	*%*
Homework	--		--	
Class project	×	50	--	
Interim examination	--		--	
Final examinations	--		×	50
Other *(describe):* …………………………	--		--	