ECTS
ΕΥΡΩΠΑΪΚΟ ΣΥΣΤΗΜΑ ΜΕΤΑΦΟΡΑΣ ΑΚΑΔΗΜΑΪΚΩΝ ΜΟΝΑΔΩΝ
ΣΤΗΝ ΕΥΡΩΠΑΪΚΗ ΕΝΩΣΗ

(B) Course information in English

General course information:

Course title:	Computational Geotechnical Engineering	**Course code:**	ΓΕ0400
Credits:	5	**Work load (hours):**	140
Course level:	Undergraduate ☑	Graduate ☐	
Course type:	Mandatory ☑	Selective ☐	
Course category:	Basic ☐	Orientation ☑	
Semester:	8th	**Hours per week:**	4
Course objectives (capabilities pursued and learning results):			
The course objective is the familiarization and implementation of numerical methods in solving geotechnical engineering problems. Comparison to the results derived using conventional methods of limit equilibrium. The learning results are the comprehension and implementation of fundamental simulation principles.			
Prerequisites:			
Solid Mechanics Soil Mechanics I, II Foundations & Retaining Structures			

Instructors' data:

Name:	Polynikis Vazouras
Level:	Teaching Assistant
Office:	
Tel. – email:	pvazour@yahoo.gr
Other tutors:	

Specific course information:

Week No.	Course contents	Hours	
		Course attendance	Preparation
1	Principles of a continuous problem approach. Methods used for solving simple and complex geotechnical problems.	4	2
2	The notion of master elements. Finite element, and finite difference methods. Formation of shape and interpolation functions of master elements.	4	2
3	Matrix equations. Definition of stiffness matrix of a uniform isotropic body. Integration by Gauss.	4	4
4	Conversion of general loading to nodal loads. Establishment of stress field - initial stress condition.	4	4
5	Fundamental principles of discretization and simulation of typical geotechnical problems. Stiffness matrix assembly.	4	4
6	Linear elasticity assumption. Constitutive equations of elastic isotropic medium.	4	4
7	Limits and conditions in applying linear elastic analysis. Non-linear behavior. Failure criteria and failure surfaces.	4	4
8	Introduction to simulation of post-elastic behavior. Analysis of a discontinuum body and the effect of discontinuities. Distinct element method.	4	4
9	Example of calculating soil settlements and strains.	4	4
10	Example of steady-stage seepage.	4	4
11	Example of soil and rock slope stability.	4	5
12	Examples of a foundation, retaining wall, and embankment	4	5
13	Example of a tunnel stability.	4	5
14	Example of a dam simulation.	4	5

Additional hours for:			
Class project	**Examinations**	**Preparation for examinations**	**Educational visit**
	3	25	

Suggested literature:

1. Comodromos, M.A. (2009). Numerical methods in geomechanics – Soil-Structures Interaction. Klidarithmos ed., Athens (in Greek).
2. Comodromos, M.A. (2019). Foundations – Retaining Structures: limit equilibrium –numerical methods,. Klidarithmos ed., Athens (in Greek).
3. Bathe, K.J. and Wilson, E.L. (1976). Numerical Methods in Finite Element Analysis. Prentice-Hall, Englewood Cliffs, NJ.
4. Chen, W.F. (1982). Plasticity in Reinforced Concrete. McGraw-Hill Book Co., New York, N.Y., 474 pp.
5. Chen, W.F, &Baladi,G.Y. (1986). Soil Plasticity - Theory and Implementation. Elsevier Science Publishing Company, Inc. NY.
6. 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.
7. Desai, C.S. (1977). Soil-Structure Interaction and Simulation Problems. In Finite Element in Geomechanics, ed. Gudehus G., John Wiley & Sons, pp. 209-250.
8. Desai, C.S. & Christian, J.T. (1977). Numerical Methods in Geotechnical Engineering. NAFEMS (1992). Introduction to nonlinear finite element analysis. Glasgow:
9. NAFEMS (1992). Introduction to nonlinear finite element analysis. Glasgow: NAFEMS (edited by E. Hinton).
10. Oden, J.T. (1972). Finite Elements of Continua. McGraw-Hill Co., N.Y.
11. Owen, D.R.J. & Hinton, E., (1980). Finite Elements in Plasticity: Theory and Practice.
12. Salencon, J. (1974). Théorie de la Plasticité pour les Applications à la Mécanique des Sols. Edit. Eyrolles, Paris.
13. Schofield, A.N. & Wroth, C.P. (1968). Critical-State Soil Mechanics. McGraw-Hill Book Co., London.
14. Smith, I. M. & Griffiths, D. V. (1988). Programming the finite element method. 2nd edition, New York, John Wiley & sons Ltd.
15. Zienkiewicz, O.C., (1977). The Finite Element Method. 3rd Edition, McGraw-Hill Book Co., New York.

Related scientific journals:

1. Geotechnique (ISSN 0016-8505)
2. Journal of Geotechnical and Geoenvironmental Engineering, ASCE (ISSN: 1090-0241)
3. International Journal for Numerical and Analytical Methods in Geomechanics (ISSN:1096-9853)
4. Canadian Geotechnical Journal (ISSN: 0008-3674)
5. Computers & Geotechnics (ISSN: 0266-352X)
6. Acta Geotechnica (ISSN: 1861-1125)
7. Soils and Foundations (ISSN: 0038-0806)
8. Geotechnical and Geological Engineering (ISSN: 0960-3182)

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

Evaluation method *(select)* - **weight:**				
	written	*%*	*Oral*	*%*
Homework	☐		☐	
Class project	☐		☐	
Interim examination	☐		☐	
Final examinations	☑	100	☐	
Other *(describe):* …………………………	☐		☐	