

ECTS

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM IN THE EUROPEAN UNION

(B) Course information in english

General course information:

Course title:	GROUNDWATER HYDRAULICS	Course code:	CE06-H06
Credits:	5	Work load (hours):	125
Course level:	Undergraduate <input checked="" type="checkbox"/>	Graduate	<input type="checkbox"/>
Course type:	Mandatory <input checked="" type="checkbox"/>	Selective	<input type="checkbox"/>
Course category:	Basic <input checked="" type="checkbox"/>	Orientation	<input type="checkbox"/>
Semester:	6	Hours per week:	4
Course objectives (capabilities pursued and learning results):			
The course objective is the calculation of saturated groundwater flow. The student develops knowledge on different approach techniques for the solution of flows through porous media. Upon the completion of the course, the student has the theoretical background to compute flows related to wells in confined and in water table aquifers, flow towards collector ditches, flow through the dam core and under the dam, etc.			
Prerequisites:			
Fluid Mechanics Mathematics			

Instructor's data:

Name:	Kanakoudis Vasilis
Level:	Associate Professor
Office:	Civil Engineering Dept. University of Thessaly Pedion Areos, 38334 Volos, Greece
Tel. – email:	+30 24210 74156, bkanakoud@civ.uth.gr
Other tutors:	

Specific course information:

Week No.	Course contents	Hours	
		Course attendance	Preparation
1	Ground and groundwater characteristics. Darcy experiment and law, range of application. Problems.	4	4
2	Permeability (hydraulic conductivity), intrinsic permeability, permeameters. Applications.	4	4
3	Continuity equation. The mathematical model. Frow nets. Boundary types and conditions.	4	8
4	Analytical methods of solution. Method of separation of variables. Numerical solution of mathematical model. Finite difference method.	4	8

Week No.	Course contents	Hours	
		Course attendance	Preparation
5	Non-isotropic, non-homogeneous soils. Analog and physical models	4	8
6	Flow in confined aquifers. Flow in unconfined aquifers. Dupuit approximation.	4	8
7-8	Steady flow to channels Μόνιμη ροή προς τάφρο: a) Flow in confined aquifers. b) Flow in unconfined aquifers. Applications	8	17
9-10	Steady flow to wells/drills: a) Flow in confined aquifers. b) Flow in unconfined aquifers. Steady 2-D and axi-symmetric flow. Applications	8	17
11-12-13	Well systems. Method of images. Applications.	12	21
14	Unsteady (time dependent) groundwater flow. Seepage force and piping (tunneling) effect.	4	4

Additional hours for:			
Class project	Examinations	Preparation for examinations	Educational visit
	3	10	

Suggested literature:

1. Papanicolaou, PN, 2007. *Groundwater Hydraulics Notes*, University Notes (in Greek).
2. Tolikas, DK, 2005. *Groundwater Hydraulics*. Epikentro Eds, Thessaloniki. (in Greek).
3. Bear, J. 1972. *Dynamics of fluids in porous media*. Elsevier.
4. McWhorter, DB and Sunada, DK, 1977. *Ground-water hydrology and hydraulics*. Water resources publications, P.O. Box 303, Fort Collins Colorado.
5. Raudkivi, AJ, and Gallander, RA, 1976. *Analysis of groundwater flow*. Arnold.
6. Todd, DK, 1976. *Groundwater hydrology*. Wiley.

Teaching method (select and describe if necessary - weight):		
Teaching	X	70%
Seminars	<input type="checkbox"/>%
Demonstrations	<input type="checkbox"/>%
Laboratory	<input type="checkbox"/>%
Exercises	X	30%
Visits at facilities	<input type="checkbox"/>%
Other (describe):.....	<input type="checkbox"/>%
Total		100%

Evaluation method (select)- weight:				
	<u>written</u>	<u>%</u>	<u>Oral</u>	<u>%</u>
Homework	X	30	<input type="checkbox"/>	
Class project	<input type="checkbox"/>		<input type="checkbox"/>	
Interim examination	<input type="checkbox"/>		<input type="checkbox"/>	
Final examinations	X	70	<input type="checkbox"/>	
Other (describe):	<input type="checkbox"/>		<input type="checkbox"/>	