GROUNDWATER HYDRAULICS

1	Course Title:	GROUNDWATER HYDRAULICS
2	Course Code:	INS5051
3	Type of Course:	Compulsory
4	Level of Course:	Second Cycle
5	Year of Study:	1
6	Semester:	1
7	ECTS Credits Allocated:	6.00
8	Theoretical (hour/week):	2.00
9	Practice (hour/week):	2.00
10	Laboratory (hour/week):	0
11	Prerequisites:	None
12	Language:	Turkish
13	Mode of Delivery:	Face to face
14	Course Coordinator:	Doç.Dr. SERDAR KORKMAZ
15	Course Lecturers:	
16	Contact information of the Course Coordinator:	skorkmaz@uludag.edu.tr 0224 24 09 04
17	Website:	http://insaat.uludag.edu.tr/
18	Objective of the Course:	To teach the groundwater hydraulics, analytical and numerical solution methods and modeling by using computer programs
19	Contribution of the Course to Professional Development:	
20	Learning Outcomes:	
	1	To comprehend the hydrological water balance and the importance of groundwater
	2	To be able to solve the groundwater flow in different aquifer types using analytical methods
	3	To be able to solve the groundwater flow in different aquifer types using numerical methods
	4	To improve the programing skills
	5	To be able to comprehend widely-used computer programs in groundwater
	6	To be able to take initiatives, manage, criticize and be in favor of the environmental factors in the solution of realistic groundwater problems
	7	To be able to present the work done in both oral and written forms.
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21	Course Content:	
	Course Content:	
Week	Theoretical	Practice
1	Hydrological water balance, geological formations, aquifer types	
2	Types of pores, karst aquifers, groundwater budget, groundwater system	

3	Continuum, representative elementary volume, characteristics of solid matrix, fluid properties, porosity	
4	Concept of head, stress and compressibility, homogeneity, isotropy, Darcy's Law, aquifer storativity, Dupuit assumption	Hydraulic conductivity computation using Darcy's Law
5	Governing equations in 2-D leaky, confined and unconfined aquifers, initial and boundary conditions	
6	1-D confined homogeneous isotropic finite aquifer, 1-D unconfined homogeneous isotropic finite aquifer with constant recharge	Hydraulic head computations in 1-D unconfined finite aquifer using Excel
7	1-D confined leaky semi-infinite aquifer	Hydraulic head computations in 1-D confined leaky semi-infinite aquifer using Excel
8	Steady radial flow in infinite confined aquifer; Steady radial flow in infinite unconfined aquifer,	Hydraulic head computations for steady radial flow in infinite confined aquifers using Excel
9	Unsteady flow in 1-D confined semi-infinite and finite aquifers	Baseflow computations using semi-logarithmic graphs in Excel
10	Unsteady flow in radial confined aquifer, spatial and temporal superposition	Piezometrichead distribution under varying pumpage rates
11	Numerical solution methods, discretization using finite difference method; Steady and unsteady flows in 1-D confined and unconfined aquifers	Solutions to unsteady flow in 1-D confined aquifers using implicit and explicit finite difference approximations using Excel and Visual Basic
12	Steady flow in 2-D unconfined aquifer	Solutions to unsteady flow in 2-D unconfined aquifers using MODFLOW
13	General review of finite difference method using MODFLOW	
14	Materials:	
15	Assesment	
16	Total work load/ 30 hr	
17	ECTS Credit of the Course	

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	3.00	42.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	14	8.00	112.00
Homeworks	8	10.00	80.00
Projects	0	0.00	0.00
Field Studies	0	0.00	0.00
Midterm exams	1	2.00	2.00
Others	0	0.00	0.00
Final Exams	1	2.00	2.00
Total Work Load			238.00
Midterm Exam	1	35.00	7.93
ECTS Credit of the Course			6.00

and Pollution. Reidel Book Co., Netherlands, 414 pp., 1987.

3.P. Polubarinova-Kochina, Roger J. De Wiest, Theory of Ground Water Movement, Princeton, 1962.

Groundwater Modeling: Finite Difference and Finite Element Methods, Freeman, 1982.

Home work-project	8	15.00
Final Exam	1	50.00
Total	10	100.00
Contribution of Term (Year) Learning Activities to Success Grade		50.00
Contribution of Final Exam to Success Grade		50.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		

24	**ECTS / WORK LOAD TABLE**

25	CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS															
	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	0	0	0	0	4	3	0	0	0	0	0	0	0	0	0	0
ÖK2	5	4	4	4	3	3	0	0	0	0	0	0	0	0	0	0
ÖK3	5	4	4	4	3	3	0	0	0	0	0	0	0	0	0	0
ÖK4	4	3	3	3	2	0	0	0	0	5	0	0	0	0	0	0
ÖK5	4	3	3	3	2	0	0	0	0	5	0	0	0	0	0	0
ÖK6	5	4	5	5	5	5	2	0	0	0	4	5	0	0	0	0
ÖK7	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
LO: Learning Objectives PQ: Program Qualifications																
Contribution Level:	**1 very low**			**2 low**			**3 Medium**			**4 High**			**5 Very High**			