

ADVANCED GROUNDWATER HYDROLOGY

1	Course Title:	ADVANCED GROUNDWATER HYDROLOGY	
2	Course Code:	INS6051	
3	Type of Course:	Optional	
4	Level of Course:	Third Cycle	
5	Year of Study:	1	
6	Semester:	1	
7	ECTS Credits Allocated:	6.00	
8	Theoretical (hour/week):	3.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:	None	
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Prof. 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:	To learn the groundwater hydraulics, analytical and numerical solution methods and modeling by using computer programs	
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 programming 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	
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	
7	1-D confined leaky semi-infinite aquifer	
8	Steady radial flow in infinite confined aquifer; Steady radial flow in infinite unconfined aquifer,	
9	Unsteady flow in 1-D confined semi-infinite and finite aquifers	
10	Unsteady flow in radial confined aquifer, spatial and temporal superposition	
11	Numerical solution methods, discretization using finite difference method; Steady and unsteady flows in 1-D confined and unconfined aquifers	
12	Steady flow in 2-D unconfined aquifer	
13	Steady flow in 2-D confined aquifer	
14	Unsteady flow in 2-D confined aquifer, General review of finite difference method	
22	Textbooks, References and/or Other Materials:	<p>1. Bear, J., and A. Verruijt, Modelling of Groundwater Flow and Pollution. Reidel Book Co., Netherlands, 414 pp., 1987.</p> <p>2. Bouwer, Groundwater Hydrology, McGraw Hill, 1978.</p> <p>3. P. Polubarinova-Kochina, Roger J. De Wiest. Theory of Ground Water Movement. Princeton, 1962.</p> <p>4. H. Wang and M.P. Anderson, Introduction to Groundwater Modeling: Finite Difference and Finite Element Methods, Freeman, 1982.</p>
23	Assesment	
TERM LEARNING ACTIVITIES		NUMBER
Midterm Exam		1
Quiz		0
Home work-project		8
Final Exam		1
Total		10
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		Written exams of numerical and theoretical questions and assignments
24	ECTS / WORK LOAD TABLE	

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	6.00	84.00
Homeworks	8	7.00	56.00
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			188.00
Total work load/ 30 hr			6.20
ECTS Credit of the Course			6.00

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			