

SULTAN QABOOS UNIVERSITY

COURSE OUTLINE

PROGRAM: water technology

1.	Course Code	SWAE4400			
2.	Course Title	Groundwater Hydrology			
3.	Credits	3CR, 12 CP, 6 ECTS			
4.	Pre-requisite Course (s)	SWAE 2201, SWAE 3303			
5.	Co-requisite Course (s)	None			
6.	Equivalent Course (s)	None			
7.	Course Category	University Requirement	University Elective		
	(Specify either as Elective or Requirement and appropriate level: College, Department, etc.)	College Requirement	College Elective		
		Department Requirement	Department Elective		
		Other (specify):			
8.	Course Owner	College: CAMS	Department:SWAE		
9.	Course Type	Lecture and Tutorial			
10.	Language of Instruction	English			

11. Course Description

This course is aimed at providing the student with a comprehensive introduction to the most important topics in groundwater hydrology/hydrogeology. The course will discuss the basic physical principles of groundwater flow. Students will gain basic knowledge of geological environments that controls the occurrence of groundwater. It discusses the physical laws that describe the flow of groundwater and the chemical evolution that accompanies flow. It is also about the influence of man on the natural groundwater regime. The following topics will be covered: groundwater in hydrological cycle, Darcy's law, hydraulic head, physical properties and principles affecting groundwater flow, determination of hydraulic conductivity, zone of aeration, and zone of saturation, types of aquifers, groundwater flows, unsaturated flows, steady and transient flows, well hydraulics, methods of wells constructions, groundwater investigations, pollution of groundwater and attenuation of pollutions, saline water intrusion, artificial recharge of groundwater.

12. Teaching/Learning Strategies

It involves: Lectures, Tuotorials, Homework, Problem solving, Reading assignments, and Field trips.

10%

13. Evaluation Methods

- A Exceptional performance
- B Very good performance
- C Satisfactory performance
- D Minimally acceptable performance
- F Unacceptable performance

The final course grade will be weighted according to the following scheme:

- (1) Homework Assignments
- (2)First Exam20%(2nd lect of week 6)

(3) Seco	ond Exam	20%	(2nd lect of	week 12)			
(5) Fina	al Exam	50%) (as schedule	ed)			
1 otal:	btal: 100%						
14. Required	Course Core Material						
Textbook: 1- Groundv Saddle F	Textbook: 1- Groundwater, Freeze, R. A., and Cherry, J. A., First Edition, 1979. Prentice Hall, Inc., Upper Saddle River, NJ 07458, USA.						
2- Groundv	vater Hydrology, Todd,	D. K., 1980. Second Edit	tion, John Wile	y & Sons, Inc.,	USA.		
Lecture No Lecture not the http://r Journals: Se Hydrogeolo	Lecture Notes: Lecture notes are available on the internet and can be downloaded from the course homepage at the http://moodle.squ.edu.om . Journals: Selected papers from related journls as: Groundwater, Advances in Water Research, Hydrogeology, Hydrological Processes, Journal of Hydrology, etc.						
15. Matching * <u>Click here</u> to	g Course Objectives with the view a list of action verbs use in	e Program Outcomes and wi developing objectives	th SQU Graduate	e Attributes			
SQU Gradua	te Attributes						
 A. SQU graduates should be able to: apply the knowledge and skills relevant to the specialization communicate effectively and use information and communication technologies critically analyze complex information and present it in simple legible manner Key and the specialization critically analyze complex information and present it in simple degible manner <lidegible li="" manner<=""> degible manner degible m</lidegible>				ates should citizenship onscious of al identity and ponsible, ommunity mindful of ry issues.			
#	Course Learning	g Objective	Relevant Program Outcome(s)		Applicable Attribute(s)		
A goo chem conce B).	A good understand about the physical and chemical properties of groundwater, basic concepts in groundwater flows, (Objectives A, and B).		 Work Work independently and in team environments at national and international levels. Learn emerging technologies and implement them for personal and employer's success. Contribute to the welfare of the society at regional and global levels. 		A1		

standards of health, safety, environment and

		professional ethics at work and soci	
	Knowledge of geological environments that controls the occurrence of groundwater, and the physical laws that describe the flow of groundwater and the chemical evolution that accompanies flow (Objectives A, and B).	• Work independently and in team environments at national and international levels.	A1, A3
2.		 Learn emerging technologies and implement them for personal and employer's success. Contribute to the welfare of the society at regional and global levels. Maintain the standards of health, safety, environment and professional ethics at work and society. Continue professional 	
		development and advanced learning throughout the career.international levels.	
	Knowledge about groundwater investigation, well constructions and well hydraulics (Objectives C, D, and E).	• Work independently and in team environments at national and international levels.	A1, A2, A3
3.		 Maintain the standards of health, safety, environment and professional ethics at work and society. Continue professional development and advanced learning throughout the career. 	
4.	Better understand of the influence of man activities on the natural groundwater regime (Objectives A, B, C, and D).		A1, A2, A3
5.	Groundwater situation in Oman, past, present, and future challenges (Objectives C, D, and E)		
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16. Student Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include the Attendance and Student Academic Misconduct policies.

For attendance, it is the student's responsibility to be punctual and to attend all classes.

Students are expected to perform their work with honesty and avoid any academic misconduct, which is defined as the use of any dishonest or deceitful means to gain some academic advantage or benefit. This can take many forms, including but not limited to, the following: copying, plagiarism, collusion and forging documents. For full details please refer to the Undergraduate Academic Regulations and to the Student Academic Misconduct Policy.

Additionally, this course requires that you:

Students should be aware of and abide by all University Regulations.

COURSE INFORMATION								
Course Code		SWAE4400	0 Course Title		Groundwater Hydrology			
Year/Semester		Spring 2018	Section		10			
Day, Time, and Place		Sunday 2:15 pm -	3:35 pr	n CMT B	14			
Course	e Coordinator	Ali Al-Maktoumi						
Office]	Location	Room 2005-	Office 1	Hours	Sundays and Tuesdays	s 10am-12 pi	: 10am-12 pm	
0.00		CAMS						
Office	Ext.	1235	Email		ali4530@squ.edu.om			
			Tenta	ative Sched	ule			
Week		Lecture/Topic		Ma	aterial to be Covered	Assignment /Exam	Weight (%)	
1	Introduction Groundwater In Hydrological Cycle Groundwater and Geological Processes		Groundwater occurance Groundwater In Hydrological Cycle Rock Properties Affecting Groundwater Flow					
2	Physical Properties and Principles Darcy's Law Hydrulic head and fluid potential, Hubert analysis of fluid potential, piezometers and piezometer nests, flow							
3	Hydrulic conductivity and permeability		estimation of hydrulicHome2%conductivity using Analyticalworkequations, laboratoryworkequations, laboratorymorkexperiments, and fieldantibolicmethods (e.g., pumping testdata)Hetrogeniety and anisotropyof hydrulic properitiesrefraction of flow lines inlavered system		2%			
4	Unsaturated flow and the water table		 water table Zone Of Aeration And Zone Of Saturation, unsaturated and saturated hydrulic conductivity, perched water table 					
5	Groundwate	er flow		Effective Conductivity: Groundwater Flow Rates And Flow Directions Flow Net Analysis				
6	Aquifers and	d Aquitards		Aquifers classifications and characterisitcs, types of Aquifers, aquitards, and aquicludes, confined,				

		unconfined ,karst aquifer,		
		poteniometric surface		
	Aquifer storativity and	Compressibility		
7	transmissivity	effective stress		
		specfic storage term		
	Steady state and transient flow	Deriving Equations Of		
		Groundwater Flow ,		
8		Numerical Solution Of		
		Governing Flow Equation		
		Using FDM,		
0	Steady state and transient flow	Solving practical problems		
9		using the FDM solution		
	Steady state and transient flow,	Steady Unidirectional Flows.		
10	cont,d	The Dupuit-Forchheimer		
		Approximations		
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APPENDIX A: INSTRUCTORS OF MULIPLE SECTIONS						
Section	Instructor	Day, Time, and Location	Office Location and Extension	Email	Office Hours	

APPENDIX B: ADDITIONAL INFOMARION

Water Technology Program Outcomes

- Work independently and in team environments at national and international levels.
- Learn emerging technologies and implement them for personal and employer's success.
- Contribute to the welfare of the society at regional and global levels.
- Maintain the standards of health, safety, environment and professional ethics at work and society.
- Continue professional development and advanced learning throughout the career.