هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	Groundwater Engineering
Course Code:	CE 4604
Program:	Bachelor of Science in Civil Engineering
Department:	Civil Engineering Department
College:	College of Engineering and Architecture
Institution:	Umm Al Qura University
Version:	1
Last Revision Date:	31 January 2025

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (level 9 or 10/5th year)					
4. Course General Description:					
This course covers the development and management of groundwater resources, focusing on their occurrence, advantages, and disadvantages. It explores the fundamentals of groundwater flow, including aquifer types, fluid movement in porous media, and Darcy's Law. Well hydraulics, discharge estimation, well design, and construction techniques are examined. The course also addresses groundwater quality assessment and related challenges. Additionally, it provides insights into groundwater resources in Saudi Arabia and methods for their sustainable development.					
5. Pre-requirements for this course (if any)**:**					
Water Resources Engineering					
6. Co-requisites for this course (if any)**:**					
Not Applicable					
7. Course Main Objective(s):					
The course aims to equip students with the essential skills and competencies required to analyze and solve complex problems in the field of groundwater engineering.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	3
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Identify and classify different types of groundwater aquifers, analyzing their key characteristics and behavior.	K.1	Through lectures, module notes, tutorials, coursework, and project	Assignments, quizzes, and written exams.
1.2	Provide an overview of groundwater quality issues and explore remediation techniques for contamination control.	K.2	Through lectures, module notes, tutorials, coursework, and project	Assignments, quizzes, and written exams.
2.0	**Skills**			
2.1	Professionally use the principles of groundwater engineering to apply the basic laws to practical problems.	S.3	Through lectures, module notes, tutorials, coursework, and project	Assignments, quizzes and written exams.
2.2	Assess and compare the appropriate methods for solving	S.2	Through lectures, module notes, tutorials,	Assignments, quizzes and

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	groundwater flow equations under a variety of situations.		coursework, and project	written exams, term project.
2.3	Design efficient groundwater wells.	S.1	Through lectures, module notes, tutorials, coursework, and project	Assignments, quizzes and written exams, term project.
3.0	Values, autonomy, and responsibility			
3.1	Exhibit commitment to professional and academic ethical standards in grounwater engineering.	V.1	Lectures and training tutorials	Project and reports
3.2	Demonstrate the ability to work both independently and collaboratively within a team, effectively communicating findings and producing technical reports.	V.2	Lectures and training tutorials	class works, project and reports

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Groundwater Engineering, Importance of groundwater, Hydrologic Cycle.	3
2.	Occurrence of groundwater, advantages, and disadvantages of groundwater.	3
3.	Surface vs Groundwater, Water balance and its components, Types of groundwater aquifers, Key Aquifer Properties.	3
4.	Fundamentals of fluids in porous media, Darcy's Law, Limitations of Darcy Law.	3
5.	Darcy's Law and groundwater flow (Steady Flow in an Unconfined Aquifer)	3
6.	Darcy's Law and groundwater flow (Steady Flow in confined Aquifer)	3
7.	Pumping test techniques, data analysis and interpretation.	3
8.	Well hydraulics, importance of well hydraulics.	3
9.	Estimation of well discharge (Confined Flow).	3

10.	Estimation of well discharge (unconfined flow).	3
11.	Well design, screen length determination, well development.	3
12.	Well construction, and Well problems.	3
13.	Concept of Groundwater Management, Groundwater balance.	3
14	Groundwater quality	3
15.	Description of groundwater resources in the kingdom of Saudi Arabia and methods of development.	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	Weekly	5%
2.	Quizzes	3 & 6 & 9,12	15%
3.	Group project	13	5%
4.	Mid-Term Exam	8	25%
5.	Final-Term Exam	16/17	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Jacob Bear, "Hydraulics of Groundwater" (2007), Dover Publications, ISBN-13: 9780486136165
Supportive References	Haque, M. I., "Mechanics of Groundwater in Porous Media", Taylor & Francis, 1st Edition, 2014, ISBN-13: 9781466585041
Electronic Materials	• Journal of Geo-mechanics, ASCE • Journal of Geotechnical and Geo-environmental Engineering, ASCE • ASCE Publications • Institution of Civil Engineers
Other Learning Materials	Non

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	White board needs to be replaced with a bigger one with all writing and other accessories.

Items	Resources
Technology equipment (projector, smart board, software)	Computer with multi-media, a printer, internet connection, and data show.
Other equipment (depending on the nature of the specialty)	Non

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	• Students • Instructor • Program leader	• Indirect • Direct • Direct
Effectiveness of Students assessment	• Independent member teaching staff	• Direct
Quality of learning resources	• Students • Instructor	• Indirect • Indirect
The extent to which CLOs have been achieved	• Instructor • Students • Program leader	• Direct • Indirect • Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**CIVIL ENGINEERING COUNCIL**
REFERENCE NO.	**THE FIFTEENTH SESSION OF THE ACADEMIC YEAR 1446**
DATE	**30 APRIL 2025**

