

<p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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CE 634 Groundwater Hydrology

College: Engineering

Department: Civil

First: Course Definition

1- Course Code: CE 634

2- Units: 3

3- Semester:

4- Prerequisite:

5- Co-requisite:

6- Location (if not on main Campus):

Second: Course Objectives

- 1- To realize *the need of hydrology as an engineering science essential for the planning, design and operation of water resource systems.*
- 2- To *Use of analytical and empirical methods for modelling the hydrological processes (precipitation, evaporation, transpiration, infiltration and runoff).*
- 3- To develop an understanding of *the flow in confined and unconfined aquifers.*
- 4- To develop an understanding of *steady and unsteady flow problems.*
- 5- To develop an understanding of the mechanics of wells.
- 6- To develop an understanding of groundwater recharge and saline water intrusion.

Third: Course Specifications

1- Topics to be covered		
Subject	No of Weeks	Units
<i>Introduction to groundwater hydrology</i>	1	3
<i>Hydrological processes related to groundwater</i>	2	6
<i>Occurrence, storage and supply of groundwater</i>	1	3
<i>Basic differential equations for flow in confined and unconfined aquifers</i>	3	9

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<i>Steady and unsteady groundwater flow problems</i>	3	9
<i>Groundwater recharge and saline water intrusion</i>	2	6
<i>Case studies related to groundwater in Saudi Arabia</i>	2	6

2- Course components (Total hrs in the Semester: 42)

Lecture	Exercise	Other
42	-	0

3- Intended Learning Outcomes of the Course (ILO's)

a. Knowledge

i) Description of the knowledge to be acquired:

- Occurrence, storage and supply of groundwater
- Basic hydraulics of wells in confined and unconfined aquifers
- Steady and unsteady groundwater flow characteristics
- Groundwater recharge
- Saline water intrusion phenomenon
- Groundwater in Saudi Arabia.

ii) Teaching strategies to be used to develop that knowledge

- Class lectures.
- Term projects.
- Students' presentations.
- Group discussion.
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iii) Methods of assessment of knowledge acquired

- Exams.
- Quizzes.
- Homework assignments.
- Term projects.

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- Occurrence, storage and supply of groundwater
- Confined and unconfined aquifers

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- Groundwater recharge
 - Saline water intrusion
- ii) Teaching strategies to be used to develop these cognitive skills**
- Class lectures.
 - Case studies analysis.
 - Term projects.

- iii) Methods of assessment of students' cognitive skills**
- Students' seminars and presentations.
 - Term projects.
 - Written reports.

c. Interpersonal Skills and Responsibility

- i) Description of the interpersonal skills and capacity to carry responsibility to be developed**
- Decision making based on engineering analysis.
 - Communication skills.
 - Team work.

- ii) Teaching strategies to be used to develop these skills**
- Class lectures.
 - Term projects.
 - Case studies analysis.
- iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility**
- Term project.
 - Written reports.
 - Students' seminars and presentations.

d. Communication, Information Technology and Numerical Skills

- i) Description of the skills to be developed in this domain**
- Literature research.
 - Problems modeling.
 - Utilization of computer applications in analysis and design.
- ii) Teaching strategies to be used to develop these skills**
- Class lectures.
 - Case studies analysis.

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- Computer lab sessions.
 - Term projects.
- iii) Methods of assessment of students numerical and communication skills**
- Term projects.
 - Written reports.
 - Students' seminars and presentations.

e. Psychomotor (if applicable) & Other Non-cognitive Skills

- i) Description of the psychomotor or other skills to be developed and the level of performance required**
- NA
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- ii) Teaching strategies to be used to develop these skills-**
- NA
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- iii) Methods of assessment of student's psychomotor skills**
- NA
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4- Student Assessment Schedule

Serial	Assessment tool (test, group project, examination etc.)	Week due	Weight
1	Term Project – 1	3 rd	15 %
2	Mid Term Exam -1	7 th	15 %
3	Term Project – 2	10 th	15 %
4	Term Project – 3	13 th	15 %
5	Final Exam	16 th	40 %

5- Student Support

- Providing electronic library of textbooks and scientific periodicals.
- Providing the necessary computer applications for the course.

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6- Learning Resources

i) Essential Books (References)

- Karamouz, M., A. Ahmadi, and M. Akhbari. " Groundwater Hydrology: Engineering, Planning, and Management," CRC Press; 1st edition, 2011
- Mays, L.W., and D.K. Todd "Groundwater Hydrology," John Wiley and Sons, Inc, 2005, ISBN-10: 0471452548, ISBN-13: 9780471452546.
- Bear, J. "Hydraulics of Groundwater," Dover Publications, 2007, ISBN-10: 0486453553, ISBN-13: 978-0486453552

ii) Course Notes

- NA

iii) Recommended Books

- Freeze, A., and J. Cherry. "Groundwater," Prentice Hall, USA, 1979, ISBN-10: 0133653129, ISBN-13: 9780133653120.
- Bouwer, H. "Groundwater Hydrology," McGraw-Hill, Inc, 1978, ISBN-10: 0070067155.

iv) Electronic Books & Web Sites:

- Scientific journals and forums.
- Instructor's instruction.

v) Periodicals

- Journal of groundwater hydrology.
- Journal of Hydrogeology.
- Journal of Hydrology.
- International Journal of Climatology.
- Journal of Environmental Economics and Management.
- ASCE scientific journals.

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students' questioners.
- Students' evaluation of course and instructor.

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ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Public faculty seminars.
- Assessment by external evaluators of students achievements.
- Instructor (Course) Report

iii) Processes for Improvement of Teaching

- Assessment of students' work by external examiners.
- Analysis of students' evaluation of course and instructor.
- Seminars by industry professionals.

iv) Processes for verifying standards of student achievement

- Check marking by an independent faculty member of a sample of student work.
- Periodic exchange and remarking of a sample of assignments/exams with a external evaluator.

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university),
- Consequently, actions are to be taken to improve the course delivery when necessary.
- Review of the course objectives, outcomes and curriculum every 2 years.