

IWR510 Advanced Hydrogeology (SPRING 2024)

Syllabus

Instructor:

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Class:

IWR510 Advanced Hydrogeology

Course will last 14 weeks,

One day a week and approximately, 3 hours a day.

Every Tuesday, 9:45-12:30 at CE 212 class

Objectives:

This course contains several subjects and applications. Firstly, determination of the distribution, movement and quality of groundwater using conventional and emerging approaches/technologies is investigated. Then, evaluation of groundwater flow, storage, recharge and discharge, in the context of resource management, by applying appropriate tests are introduced. Chemical and biogeochemical factors affecting the composition and evolution of groundwater chemistry is assessed. At last, knowledge obtained from the course to addressing problems of importance to the minerals and/or water resources industry is investigated with computer programs related with the area.

Course Contents:

1. Overview of hydrogeology
 1. Introduction to hydrogeology
 2. History hydrogeology
2. Groundwater occurrence
 1. Hydrologic cycle
 2. Water
 3. Precipitation, evaporation and transpiration and water balance
3. Aquifer
 1. Aquifer types and properties
 2. Aquifer hydraulic parameters
 3. Darcy's Law
 4. Hydrodynamics of porous mediums
4. Groundwater flow
 1. Groundwater flow
 2. Recharge
 3. Discharge

4. Spring
5. Groundwater interaction with surface water
6. Groundwater dependent ecosystem
5. Groundwater pumping.
 1. Pumping test
 2. Cone of depression
 3. Bore construction
 4. Groundwater interference
 5. Entitlement
 6. Allocation
 7. Karst topography
 8. Groundwater contamination
 9. Solution to groundwater flow equations
6. Groundwater flow to wells
 1. Basic assumptions
 2. Theis method– planning, performing and evaluating
 3. Cooper - Jacob method – planning, performing and evaluating
 4. Steady flow confined aquifer (Thiem solution)
 5. Steady flow unconfined aquifer
 6. Groundwater flow lines and flow nets
7. Groundwater monitoring and modelling
 1. Groundwater
 2. Groundwater modelling
 - a) Analytical
 - b) Numerical
 3. Applied groundwater flow and contaminant transport modeling
 4. Groundwater sampling/analysis
 5. Groundwater pollutants
 6. Groundwater monitoring
 - a) Hydrograph
 - b) Recovery level
 - c) Drawdown level
 - d) Nested monitoring bores
 - e) Water table
 - f) Potentiometric surface
 7. Groundwater quality
 - a) Groundwater chemistry (basic)
 - b) Contamination sources
 - c) Groundwater monitoring
 - d) Groundwater remediation/restoration
8. Water monitoring
9. Groundwater supply
 1. Design of a water supply
 2. Artificial recharge
 3. Groundwater protection (wellhead protection zoning)

Grading:

Midterm exam: 30%

Project reports (Presentation + Report): 40%

Final Exam: 30%

Textbook and reference books:

1. Weight, W.D. Manual of Applied Field Hydrogeology, 2004 The McGraw-Hill Companies.
2. Brassington, R. Field Hydrogeology, third edition, John Wiley & Sons Ltd. 2007.
3. Drever, J.I. Surface and Groundwater, Weathering, and Soils, Treatise on