

HWR/GEOS 431/531 - Hydrogeology - Fall 2017

Dr. Marek Zreda

Harshbarger 230

(520) 621-4072 (office)

marek@hwr.arizona.edu

<http://quebec.hwr.arizona.edu/classes/hwr431/hwr431.html>

Lectures:

Monday, Wednesday, Friday 12:00-12:50,
Mines 213.

Labs:

Tuesday, 14:00-16:50; Harshbarger 208.
TA: Kilian Ashley
(ka6542@email.arizona.edu).

Office hours:

Monday, Wednesday, Friday 13:00 - 14:00.
And any time when I am in the office.
And by appointment.

Course objectives and expected learning outcomes:

To learn about physical, chemical, hydrologic and geologic factors that control the occurrence and dynamics of groundwater. Students will develop the ability to investigate groundwater systems and to solve simple problems in basic and applied hydrogeology.

Prerequisites:

GEOS 251, MATH 129 (or equivalents).

Grading:

Homework 25%.
Midterm exam 25%.
Final exam 25%.
Lab 25%.

TOTAL 100%.

Requirements:

Do homework assignments.
Pass both exams.
Do all lab assignments.

Final grades:

Floating curve rather than fixed scale.
Rule of thumb: to get an A in class, student should have at least a B in everything; similarly, to get a B, shoot for at least a C, etc.

Textbook:

Freeze and Cherry, 1979, Groundwater, Prentice Hall.
Class notes (<http://quebec.hwr.arizona.edu/classes/hwr431/hwr431.html>).

Homework:

Approximately eight assignments to be posted on the class server. Will be graded.

Lecture topics:

(not necessarily equivalent to class hours)

1. Relation of hydrogeology to other disciplines
2. Water cycle
3. Course organization
4. History of hydrological concepts
5. Soil moisture, wetting and infiltration, recharge
6. Physical and chemical properties of water
7. Types and origin of subsurface water
8. Flow through saturated soil column, Darcy's law
9. Hydraulic head and its components
10. Seepage velocity, validity of Darcy's law
11. Navier-Stokes equation and its integration
12. Factors controlling flow in porous media
13. Porosity and permeability and their origins
14. Types of rocks and their hydraulic properties
15. Hydraulic conductivity and its typical values
16. Hydraulic conductivity of heterogeneous media
17. Description of soil heterogeneity
18. Anisotropy of hydraulic conductivity
19. Depositional environments and facies
20. Postdepositional processes modifying geological materials
21. Aquifers and aquitards
22. Potentiometric surface
23. Storage of water, specific yield and specific storage
24. Darcy's law in three dimensions
25. General continuity equation
26. Groundwater flow equations
27. Flow in fractures
28. Horizontal flow and concept of transmissivity and storativity
29. Horizontal flow in phreatic aquifer
30. Graphical solutions to steady flow in two dimensions
31. Equipotentials, streamlines and flow nets
32. Methods of groundwater resources evaluation
33. Parameter estimation using aquifer pumping tests
34. Principle of superposition and method of images
35. Recharge, infiltration and unsaturated flow
36. Storage in unsaturated media
37. Hydraulic conductivity of unsaturated media
38. Geology and ground water
39. Regional flow
40. Interactions between ground water and surface water
41. Groundwater fluctuations
42. Introduction to aqueous chemistry
43. Chemical reactions, major ions
44. Equilibria and disequilibria
45. Water chemistry in different geological environments
46. Carbonate system
47. Hydrologic tracers and their applications
48. Environmental isotopes, groundwater dating
49. Carbon-14, chlorine-36 and tritium methods of dating ground water
50. Solute transport, advection, dispersion, diffusion
51. Groundwater contamination
52. Sea-water intrusion, salinization