



Advanced Applied Hydrogeology

The University of Toledo
Department of Environmental Sciences

EEES-6450, (61876)

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|-------------------------|---------------------------------------|------------------------|----------------------|
| Instructor: | James Martin-Hayden | Term: | Fall 2015 |
| Email: | James.Martin-Hayden@UToledo.edu | Class Location: | BO-1014 |
| Office Hours: | M-Th, 11:30am-12:45pm | Class Day/Time: | TBA (MW 1:00-2:30pm) |
| Office Location: | BO-3051A (in back of lab BO-3051) | Credit Hours: | 3 |
| Office Phone: | 419-530-2634 (use email if no answer) | | |

COURSE/CATALOG DESCRIPTION

Applications of hydrogeological monitoring, analyses, and modeling using mathematics, statistics and computers. Subjects include: well field and pump test design, sampling strategies, data presentation and analysis, and modeling fundamentals.

COURSE OVERVIEW

Advanced Applied Hydrogeology is a graduate level course during which students apply hydrogeological tools, methods and analyses to actual field investigations. In the beginning of the semester students are introduced to a local field site and hydrogeological problem that they will investigate. The students then apply various hydrogeological methods to characterize the site and address the problem. These investigations will involve developing a conceptual model and applying the appropriate mathematical modeling to help understand hydrologic processes and interactions at the site. The field portion of this course will involve collecting data to further develop and calibrate the models. Finally, the data collected and the analyses performed will be compiled into a hydrogeological report. .

STUDENT LEARNING OUTCOMES

Upon completing this course, the student will be able to:

1. Design and install piezometers, monitoring wells and pumping wells
2. Apply 3-D Darcy's Law and the flow equation to analyze groundwater flow
3. Develop site-specific conceptual models (SCM)
4. Set up finite-difference groundwater flow models with boundary conditions and parameter distributions
5. Application of boundary conditions and discretization to (SCM)
6. Map and analyze potentiometric surfaces to calculate groundwater fluxes, volumetric flows and velocities
7. Design, perform and analyze hydraulic testing using permeameters, slug tests, and pump tests
8. Synthesize hydrogeological investigations into final report.

TEACHING STRATEGIES

Since Hydrogeology is a field discipline, Advanced Applied Hydrogeology is designed to give students experience with collecting data from the field, analyze those data to address objectives outlined and compiling the results into a hydrogeological characterization.

PREREQUISITES AND COREQUISITES

EEES 4410/5410



PRIMARY TEXTS AND ANCILLARY MATERIALS

Applied Hydrogeology, Applied Hydrogeology, 3rd. ed. by C.W. Fetter, Macmillan College Publishing, Inc. (or other introductory hydrogeology text)

Physical and Chemical Hydrogeology, 2nd ed., P.A. Domenico and F.W. Schwartz, John Wiley & Sons Inc., 1997.

Introduction to Groundwater Modeling, H.F. Wang and M.P. Anderson, Academic Press, 1982.

American Society for Testing and Materials (ASTM) Standards: Handouts.

GRADING

The class is divided into a series of seven projects each worth 10% of the final grade. The final project will be a compilation of the data, analyses and results into a final report worth 30% of the final grade.

COURSE SCHEDULE

| | Week | Topics (may be rearranged depending on field availability and weather) | [Project] |
|-------|---|--|----------------------------|
| 8/24 | 1 | Introduction to field hydrogeology | |
| 8/31 | 2 | Preliminary site investigation | |
| 9/7 | 3 | Development of Conceptual Site Model (CSM) → | [Project 1, due 9/14] |
| 9/14 | 4 | Installation of piezometers, monitoring wells and pumping wells | |
| 9/21 | 5 | Sampling and sediment characterization and boring logs → | [Project 2, due 9/28] |
| 9/28 | 6 | Field survey of hydraulic features, wellheads and topography | |
| 10/5 | 7 | Hydraulic testing: Permeameters, slug tests → | [Project 3, due 10/12] |
| 10/12 | 8 | Hydraulic testing (cont.): Pump tests | |
| 10/19 | 9 | Potentiometric surface and pump test analyses → | [Project 4, due 10/26] |
| 10/26 | 10 | 3-D Darcy's Law and the Flow equation | |
| 11/2 | 11 | Introduction to finite-difference groundwater flow modeling → | [Project 5, due 11/9] |
| 11/9 | 12 | 3-D finite-difference modeling and boundary conditions | |
| 11/16 | 13 | Application of boundary conditions and discretization → | [Project 6, due 11/23] |
| 11/23 | 14 | Potentiometric surface analyses and model calibration | |
| 11/30 | 15 | Synthesis of investigations into hydrogeological report → | [Project 7, due 12/7] |
| 12/7 | 16 | Tie up and review | |
| 12/14 | Finals Week, Final Project: Due Wed., December 16th | | [Final Project, due 12/16] |

TECHNOLOGY REQUIREMENTS

Advanced Applied Hydrogeology requires access to a personal computer to log data, perform analyses, and complete assignments. The software used includes Microsoft Excel or any suitable spreadsheet program that allows the analysis and graphing of tabulated data. Access to Blackboard is required to obtain homework assignments, lecture outlines, data set and maps.

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA.) The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance](#).

Academic Accommodations

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the [Student Disability Services Office](#).