COURSE SYLLABUS

OBERLIN COLLEGE
GEOL 242: GROUNDWATER HYDROGEOLOGY, SPRING SEMESTER 2013

Instructor's name: Dr. Joseph Asante
Email: joseph.asante@oberlin.edu
Office: Carnegie 404
Phone number: 440-775-8714

Office hours: Mon 1:00-2:30PM & Wed 1-2:30PM or By Appointment
Lectures: Tuesdays & Thursdays 11:00 - 12:15PM in Carnegie 212
Laboratory: Thursdays 1:30 – 4:20PM in Carnegie Carnegie 212
Required textbook: Applied Hydrogeology, by C.W. Fetter, 2001, 4th Ed., Prentice Hall, Upper Saddle River, New Jersey

Other useful references:

- Groundwater by R. A. Freeze and J. A. Cherry, 1979, Prentice Hall
- Basic Ground-Water Hydrology by R. C. Heath, 1983, USGS Water Supply Paper 2220
- Physical and Chemical Hydrogeology by P. A. Domenico and F. W. Schwartz, 2nd Edition, 1998, Wiley
- Quantitative hydrogeology by G. de Marsily, 1986, Academic Press Inc., New York

Course description and format:

Geol 242 will introduce students to several aspects of hydrogeology. The course will focus on understanding of the hydrological cycle and processes, geologic framework and groundwater occurrence, principles of subsurface water movement, methods of mapping and developing/managing groundwater, principles of aqueous geochemistry and approaches for characterization of water types as well as transport of contaminant in groundwater.

The format of the course will be lecturers, problem sets, laboratory experiments, and field measurement. Also the instructor will assign weekly reading chapters or research papers to students for in-class short open book quizzes or discussions.

Course learning outcomes:

A student who successful completes this course will be able:

- Explain Darcy's equation, properties of porous materials and how these affect subsurface water movement, Laplace equation, diffusion equation, factors controlling regional groundwater flow, and basic principles of modeling and hydrochemistry
- to conceptualize hydrologic problems and solve them applying Darcy equation, analytical techniques, and flow nets, using paper and pencil, graph sheets, excel, and software
- perform particle size analysis and use the distribution to estimate infiltration rate and design filter pack for wells

- conduct pumping test, collect and analyze the data to determine aquifer parameters and to predict the response of aquifer to pumping stress
- measure, oxygen, pH, temperature, Alkalinity of groundwater as well as analyze, interpret, and discuss hydrochemical data

Week : Starting	Topics	Readings from Fetter 4th /Comments	Lab activities (experiments, field, and problem sets with data)
1 : 2/4	Course overview Importance of groundwater Structure and Properties of water	Sects. 1.1, 1.2, 1.6-1.12	Dimensions, units conversions, significant figures, surface area and volume calculations
2 : 2/11	Geology and Aquifer systems	Chapter 8, Sects 3.7	Particle size analysis, soil texture, and hydraulic conductivity
3 : 2/18	Water budget; Hydrologic cycle and hydrologic processes	Sects. 1.3, 1.5,2.1-2.8	Water budget analysis
4 : 2/25	Geologic control of groundwater occurrence	Sects. 3.1-3.3, 3.9-3.11 Examination 1	Saturated hydraulic conductivity and permeability
5 : 3/4	Principles of subsurface water movement	Sects. 3.4-3.6, 4.1-4.6, 6.3, 6.6	**Field trip1:** local geology and hydrogeology
6 : 4/11	Regional groundwater flow; Diffusion equation	Chapter 7, Sects. 4.7-	Solve regional groundwater flow using ArcGIS Capillary rise experiment
7 : 3/18	Analytic solutions to groundwater flow; flow nets	Sects. 3.12, 4.10-4.14 Examination 2	Solve groundwater problem using flow net
8 : 3/25	Spring Recess		
9 : 4/1	Groundwater flow to wells	Chapter 5	Aquifer test analysis using pencil-paper and Aquifer Test software
10 : 4/8	Groundwater flow to wells	Chapter 5	Aquifer test analysis using pencil-paper and Aquifer Test software
11 : 4/15	Well Design and construction; Pumping test	Chapter 5 Class handout	**Field Trip2:** Conduct pumping test at Jones farms and analyze your data
12 : 4/22	Introduction to aqueous geochemistry: Basic principles and classification of water types	Sects. 9.1-9.9, 9.13-9.14	**Field trip3**; Sampling, analysis, and presentation of water quality data (AquaChem and WATEQ4F)
13 : 4/29	Introduction to Contaminants transport in groundwater	Sects. 10.6-10.10	Analytical solutions of solute transport
14 : 5/6	Introduction to groundwater modeling	Chapter 13	Groundwater modeling with Excel spreadsheet or Processing Modflow software
15 : 5/13	Final Examination TBA	Examination 3	

Read!! Important information about Lab experiments, field measurements, and problem sets

Students are responsible for handing in all completed assignments for scoring. Most assignments will have a weekly due date and this will be written at the top of all assignments. I will try to remind students about the due dates for assignments; however, it is your responsibility to read instructions' for all assignments, laboratory, or field exercises thoroughly and submit them by the due date. For work turned in late for a first time, I will deduct 5%, for a second time 10% and so on. In all work I encourage discussion among students; however the work each student turns in for grading must be of their own individual effort and understanding. Due to time and logistics constraints, in most cases students will work in groups (3-5) to perform laboratory experiments or field measurements. Most laboratory calculations will be done by hand or excel. Students will have the opportunity to use AquaChem, Aquifer Test, and WATEQ4F, which are used in industry and research, to solve problems which they have solved by hand and to compare the manual and software solutions. In some cases your assignment write-up will be in a report format and the report will include your interpretations, discussion, and conclusions drawn from your data to support the hypothesis or objective of the activity.

Blackboard

The class will utilize Blackboard. Blackboard is an online course-management system that is accessible with your ObieID. Through Blackboard, you will receive important announcements from me, communicate with me, communicate with classmates, access course materials, and participate in other activities I explain during the semester. You can login at http://blackboard.oberlin.edu. *Supplemental readings, assignments, and other relevant information will be posted on Blackboard.*

Laboratory and Field Trip Fee

Due to field trip costs and lab expendables, there is a laboratory fee of $10 that will be collected from each of you. The fee helps to offset the cost of renting vans and purchasing maps, etc. Please pay your fee to Mrs. Pat Sturges in the department office.

Computers and phones in Class and Labs or Field

Respect the privacy of your colleagues and professor. Phones and other digital devices are not to be used during class time. If I see such a device during class, I will take it away until the end of class. I commit to not using my phone during your class and I need your commitment that you won't use your phone during my class.

When you are in class, it is not acceptable (although it is tempting) to have email, Facebook, Twitter, or other websites unrelated to class up on the screen during class. If we are having a discussion, we will try to move seats to some arrangement where we aren't all tempted to stare at computers. Because our time is limited, whenever we need to use a computer I advise that you be in class with your computer booted and ready to go when class starts so that we can get started promptly.

Disability Services
If you have a documented disability that may require special accommodation you will need to contact the Office of Disability Services for coordination in your academic accommodation. They will supply you with a letter to share with me so that I know what accommodations you need and can arrange to meet those accommodations. The Office of Disability Services is located in Peters G-27/G-28.

Student evaluation and grading policy:
Generally, your work will be graded based on the following rubrics. For each question I will use these criteria for scoring

1) Did you answer the question *(1 point)*
2) Is your approach logical or solution steps shown *(6 points)*
3) Is your answer correct *(2 points)*
4) Did you use appropriate language and style (significant figures, neatness, terminologies, organization, and presentation) *(1 point)*

13 Laboratory exercises (equally weighted) – 50%
Three examinations (each of the first 2 exams– 10%, final exam – 16%) – 36%
7 Short in class quizzes and problem solving – 14%
Total = 100%

A = 93-100%	B^- = 80-82.9%	D+ = 60-69.9%
A^- = 90-92.9%	C+ = 77-79.9%	F = 00-59.9%
B+ = 87-89.9%	C = 73-76.9%	
B^- = 83-86.9%	C^- = 70-72.9%	