WATER / GEOLOGY 383/583: HYDROGEOLOGY

Fall Semester, 2018

Instructor: David L. Ozsvath, Room: D-332A, Science Building, Phone: 715-346-2287

Office Hours: Monday or Wednesday from 2:00 to 4:30; and Friday from 9:00 to 11:00

Course Overview:

This course examines principles of groundwater occurrence, movement and utilization as a resource. The emphasis of the class is on applied hydrogeology, learning how theories relate to actual field conditions. Much of the class will be spent working on assignments that provide opportunities to solve a variety of hydrogeological problems. Thus, students are expected to compete the reading assignments and read the online lecture notes prior to each class and to come prepared to participate in the classroom activities.

Course Objectives:

The readings, lectures, assignments, and exams are intended to help students both learn and demonstrate that they understand:

1. how the surface topography, surface water hydrology and geology influence the occurrence and recharge of groundwater;
2. how to construct hydrologic budgets for groundwater basins;
3. the concepts of safe yield and sustainability;
4. the significance of aquifer properties and how they vary in natural environments;
5. the concept of hydraulic head, how it is measured, and its importance to ground water movement;
6. how to create potentiometric surface maps and to measure both horizontal and vertical hydraulic gradients;
7. how to use Darcy's Law to calculate groundwater discharge and average linear flow velocity;
8. the relationship between surface water and groundwater;
9. how to use drawdown measurements taken in monitoring wells during pumping tests to infer aquifer hydraulic properties;
10. how to use aquifer properties to predict drawdown near a pumping well;
11. the principles of delineating recharge areas and well head protection areas.

Required Text:

Applied Hydrogeology (4th ed.) by C. W. Fetter, Jr. (2001) has an associated web site: http://www.appliedhydrogeology.info/, which has corrections to errors in the textbook and provides solutions to odd-numbered problems at the end of each chapter.

There is also a D2L web site associated with the course. In addition to announcements, this site contains lecture notes and handouts needed for all of the assignments.

Attendance Policy:

Attendance is expected at every meeting, and class participation will factor into the final grade (see Grading Policy). During many class meetings (20 times during the semester) students will work on in-class assignments. These assignments are not graded, but to receive credit, a student must have been present and completed the assignment.

Grading Policy:

Final grades are determined from two hour exams, class participation, and a final exam.

GRADING INSTRUMENT	VALUE	WEIGHT
Semester exams (2)	26% each	52% of final grade
Class Assignments (20)	1% each	20% of final grade
Final Exam (1)	28% each	28% of final grade

Final letter grades in the course will include the plus and minus option. In no case will an incomplete be granted unless the student has a long-term illness or a family emergency. A student in one of these situations must arrange for an incomplete with me prior to the end of the semester.

Examinations:

Each of the exams will be an **open book, open note** test and will cover the material from both lecture and laboratory sessions. The emphasis of these tests is on problem solving, although short-answer questions are also included. Exams from previous years are not available, but I do assign optional, review questions at least one week prior to the date of a test (solutions to those questions can be found at the Applied Hydrogeology web site). Exams are scheduled during a two-hour lab session to provide sufficient time to finish.

"Make-up" exams may be given *only* to those students who have *prior* approval from the instructor. Illness is a valid excuse *only* when the student has verifiable evidence of that illness from a doctor. There will be *no* "extra credit" available for missed exams.

Student Responsibilities:

Student rights and responsibilities, including the behaviors that are expected of students and faculty in the classroom environment, are described on pages 2 through 4 of a UW-System online document: http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf.

SCHEDULE OF LECTURES, ASSIGNMENTS, EXAMS, AND READINGS

DATE	LECTURE TOPIC OR IN-CLASS ASSIGNMENT	READINGS
09/04	Introduction; Hydrologic Basins and Water Budgets	1-23; 236-243
09/05	Water Budget Calculations for Schmeekle Reserve	441-449
09/06	"Safe Yield": Irrigation Effects in the Central Sands Region	Online Article
09/11	Porosity, Specific Yield, and Groundwater Occurrence	69-81; 223-234
09/12	Seasonal Patterns of Recharge in the Central Sands	225-234
09/13	Effect of Climatic Variations on Water Table Recharge	24-42
09/18	Baseflow and Recharge Rates with Portage County	42-51
09/19	Intrinsic Permeability and Hydraulic Conductivity	81-90; 469-474
09/20	The Water Table, Aquifers, Confining Beds, and Springs	93-98; 248-250
09/25	Sedimentary Bedrock Aquifers of South Dakota	268-272
09/26	Transmissivity, Storativity, Heterogeneity and Anisotropy	100-106
09/27	Hydrostratigraphy: Calculating Aquifer Properties	297-323
10/02	Groundwater Movement in Fractured, Crystalline Bedrock	319-321; 469-474
10/03	**EXAM 1**	---
10/04	Piezometers, Hydraulic Head, and Hydraulic Gradients	113-122
10/09	Flow Net Construction for Homogeneous, Isotropic Media	132-136
10/10	Flow Net Construction for Schmeekle Reserve	272-278
10/11	Flow Net Construction for Heterogeneous, Isotropic Media	136-138
10/16	Flow Net Construction for Homogeneous, Anisotropic Media	131-132
10/17	Darcy's Law, Discharge, and Groundwater Flow Velocity	122-125; 401-403
10/18	Steady State Groundwater Flow in Confined Aquifers	138-140
10/23	Groundwater Flow Net Analysis for Schmeekle Reserve	138-140
10/24	Steady State Groundwater Flow in Layered Systems	268-272
10/25	Groundwater Flow in Layered Bedrock of South Dakota	268-272
10/30	Groundwater Flow in Layered Bedrock of South Dakota	268-272
10/31	Steady State Groundwater Flow in Unconfined Aquifers	140-146
11/01	Steady State Flow and Discharge to the Tomorrow River	140-146
11/06	Groundwater Interaction with Lakes and Streams	272-278; 46-48
11/07	**EXAM 2**	---
11/08	The Design and Purpose of Aquifer Pumping Tests	210-213
11/13	The Response of Confined Aquifers to Pumping	150-156
11/14	Analyzing Pumping Test Data From Confined Aquifers	169-177
11/15	The Response of Semi-Confined Aquifers to Pumping	177-183
11/20	Using Aquifer WIN^{32} to Analyze Pumping Test Data	177-183
11/21	Opportunity to Make Up Missed Assignments	---
11/27	Predicting Drawdown in Confined / Semi-Confined Aquifers	177-183
11/28	The Response of Water Table Aquifers to Pumping	184-188
11/29	The Effects of Partial Well Penetration on Drawdown	188-190
12/04	Calculating Drawdown Caused by Well Interference	207-209
12/05	Pumping Tests Influenced by Hydrogeologic Boundaries	208-209
12/06	Boundary Characterization Using the Law of Times	208-209
12/11	Surface Water Infiltration Induced by Pumping Wells	46-48
12/12	Wellhead Protection and the Zone of Influence (ZOI)	WRIR 03-4320
12/13	Protection Area Delineation Using Capture Zone Analysis	436-439
12/17	**FINAL EXAM (8:00 AM)**	---