HYDROGEOCHEMISTRY

**GLY 5245, Section 401C; GLY4930, Section 4208**

**Spring 2019**

**Instructor:** Dr. Jon Martin

**Office:** 382 Williamson Hall

**Phone:** 392-6219

**Email:** jbmartin@ufl.edu

**Office Hours:** 2-3 pm Tues/Thurs or by appointment (call or email first)

**Meeting Place:** 210 Williamson Hall

**Meeting Time:** Wed/Fri TBD; some fraction of 2nd and 3rd periods (8:30 to 10:25)

**Recommended Text:** *Geochemistry of Natural Water, 3rd edition*, by James Drever- out of print

**Useful texts:** *Aqueous Environmental Geochemistry*, Donald Langmuir

*Aquatic Chemistry,* Werner Stumm and James Morgan

 *The Global Water Cycle* Elizabeth Berner and Robert Berner

*Geochemistry, groundwater and pollution, 2nd edition*, by CAJ Appelo and D. Postma

**Objectives and learning outcomes:**

 The objectives of this course are to introduce you to thermodynamic and kinetic controls on the chemical composition of “natural” water (i.e., we will not study waste water, water management, water treatment plants, or similar engineered systems). We will apply these fundamental chemical principles to a variety of reactions, mostly between fresh water and the atmosphere, carbonate, silicate, and iron-oxide minerals, as well as reactions in seawater and with other mineral phases. At the end of the class, you should:

1. have a thorough understanding of the theory behind the chemical controls on natural water in multiple systems (groundwater, surface water, seawater);
2. be able solve fundamental problems related to the control of water chemistry and reactions between water and rocks, minerals, and organic carbon;
3. have sufficient proficiency in several computer models to solve similar problems using the programs.

**Class Logistics:**

The course will include lectures on material from various textbook and other sources. The lecture material will be reinforced by occasional problem sets, approximately one every week or two. The problem sets will be turned in individually, but I encourage working collectively on the problem sets. We may have occasional recitation sessions in class to work over some of the problems Some ground rules for the homework:

**NEATNESS COUNTS**. If I don’t understand your answers, it will be a problem.

**NO LATE WORK WILL BE ACCEPTED!**

Some of the problems will require the use of geochemical modeling programs including Geochemist Workbench (a commercial product) and PHREEQc. Some of the exercises may be completed using Excel and it is often easier to manipulate data in excel and then copy them into the various programs. I assume everyone is familiar with Excel, but if not, please let me know and we will go over that program as well. We will start with Geochemist Workbench. You can download a student version for free after jumping through a few hoops. You should start to get the program immediately – it will be used in the initial problem set. Check on their website at <http://student.gwb.com/student_overview.php> for information. We will use the another programs later in the semester. I will provide details then, but if you are curious, you may download it at <http://wwwbrr.cr.usgs.gov/projects/GWC_coupled/phreeqc/> for PHREEQc.

As I write this syllabus, only five people are signed up for the class In addition, there is no good single text available any longer. Both of these issues limit using standard team-based learning (TBL) techniques. Consequently, I plan to use a modified version of TBL; specifically, I will periodically, probably every two to three weeks give short, multiple choice quizzes that will follow the format of Readiness Assurance Tests (RATs). (Strictly speaking these test will be more evaluatory, rather than “readiness assurance”). They will be done individually (iRATs) and then immediately afterward they will be completed collectively by the class (tRATs). One cumulative final will take place the last day of class and that exam will be completed individually.

## Grading policy:

 Grades will be assigned on the basis of the problem sets, quizzes and the final exam.

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| **Work Required** | **Tentative Dates** | **Total Value (%)** |
| Homework | Variable | 60 |
| iRAT | Variable | 5 |
| tRAT | Variable | 15 |
| Final exams | April 19 | 20 |
| Total |  | **100** |

Grading scale: >93 = A; 90-92 = A-; 87-89 = B+; 83-86 = B; 80-82 = B-, etc. Values will be rounded to nearest whole numbers

**Here is some more information, some common sense, other required by the University:**

1) Missing the final is highly discouraged, but a make-up exam will be granted if a written excuse is brought from a doctor (for illness) or mortician (for a death in the family). It will be impossible to make up the RATs.

2) I will be posting various bits of information on Canvas and you should all have access to this website. Please let me know if you don’t have access.

3) Although the class may be largely lecture format, I encourage questions and discussion. To encourage discussion, please speak loudly enough for all in the class to hear your questions and/or comments. Whispering to your friends will not be tolerated. If you whisper to your friends, I may ask you to speak up so we can all hear.

4) Attend all classes – most of the test material will come from the lectures. I will not require attendance in the class unless it drops off through the semester. If I am forced to take attendance, the grading policy will shift to reflect that change.

5) Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

6) I expect professional behavior in the class at all times. Please show up for class on time and turn off cell phones.

7) All students are expected to follow the University honor code: neither give nor receive unauthorized aid in doing any assignment. Not adhering to this policy will result in a failing grade.