Course Syllabus
SWS 4451/5406
Soil and Water Chemistry
3 Credits

Instructor: G.A. O’Connor, Office: 3169 McCarty Hall A, Email: gao@ufl.edu

Office hours: Flexible, email for an appointment

Graduate Assistant: Harman Sidhu, hsidhu@ufl.edu, PhD Candidate

Course Overview: The ability of soil to function as a medium for plant growth and/or waste disposal, a purifier of water, a determinant of contaminant fate and transport, etc. is inextricably tied to chemistry. Applying basic principles of chemistry to processes that occur commonly in soil/water systems is, thus, fundamental to understanding and optimizing soil functions. Successful approaches range from applied (empirical) to basic (theoretical) studies and conceptualizations. This course utilizes the full range of approaches, with emphasis on the soil solution and the various soil components and chemical processes influencing its chemistry.

Course Objectives: 1) Strengthen the student’s understanding of basic chemical principles; 2) Teach students how to apply the principles to soil/water chemical processes; and 3) Demonstrate how chemical knowledge helps explain soil functions.

Prerequisites: Introduction to Soils (SWS 3022 or SWS 5050), General Chemistry (CHM 2046 or equivalent), or permission of the instructor.

Course Format: Three 50 minute lectures per week; M, W, and F; Period 5

Frequency: Yearly, Fall semester

Textbook: There is no required text for the course. Rather, readings will be assigned from two excellent soil chemistry texts on 2-hr reserve in the Marston Library, via the course reserve list (ARES). The Bard book (Chemical Equilibrium) is one of any number of texts covering chemistry basics, and is also on the course reserve list. Students will also have access to PDFs of a revision of Soil Chemistry, originally written by H.L. Bohn, B.L. McNeal and G.A. O’Connor. The latter will be the main reference for the course.

2. Environmental Soil Chemistry, 2003 (2nd Edition), by Donald L. Sparks, University of Delaware, [Academic Press]

See also http://www.khanacademy.org/ and http://education-portal.com/academy/course/index.html for excellent basic chemistry lesson videos
Student Responsibilities:

1. Study assigned readings in anticipation of lecture coverage

2. Actively participate in class discussions. **Class attendance and engagement is strongly recommended** (and rewarded – see below)

3. Demonstrate mastery of presented material by passing written examinations and successfully completing assigned homework.

4. Demonstrate common courtesy by ensuring that cell phones and other electronic devices are turned off, arriving to class on time, and removing any personal trash.

Evaluation of Students:

1. Three hour examinations, each 100 points (undergraduates, total 300 points) or 125 points each (graduate students, 375 points total) will be given. **Make up exams are rarely authorized and must be medically justified and authenticated.** See UF policies at [https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx](https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx).

2. Homework assignments will be assigned regularly, and will be graded (total scaled value 100 points). Unless otherwise stated, all assignments must be submitted in class on the due date. Late homework assignments are penalized 20% for each 24 hour period after the beginning of class on the due date. **You cannot pass the course unless you complete each course requirement/assignment.**

3. Graduate students will also be required (and undergraduates offered the opportunity) to complete an extra assignment (100 points) approved by the instructor. Extra assignments may consist of developing experiential exercises (e.g., labs, demonstrations, homework sets), development of Reusable Learning Objects (RLOs, see EcoLearnIt [http://ecolearnit@ifas.ufl.edu](http://ecolearnit@ifas.ufl.edu)), class presentations demonstrating advanced applications of chemical principles to soil/water problems, etc. **Selection of the assignment topic must be completed and approved by the instructor within one week of the return of the 1st exam, followed by a detailed outline of the activity one week later (5% of grade).**

**Grading Scale:** Course grades are determined by summing all scores, dividing by the maximum score possible (400 or 500 points for undergraduates and 575 points for graduates), and multiplying by 100. Letter grades are assigned as follows: 100-92% = A, 91-90% = A-, 89-87% = B+, 86-82 = B, 81-79% = B-, 78-75% = C+, 74-70% = C, 69-65% = D+, 64-60% = D. ≤59 = F. The instructor reserves the right to **add 0-5 points to the final percentage score** based on his subjective evaluation of student interest, meaningful class participation, and overall dedication to the course. **Regular communication (appointments) with the instructor is strongly**
encouraged. See UF policies at https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Academic Honesty
As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.” You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/SCCR/honorcodes/honorcode.php.

Software Use
All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate. Students may be required to download and install a free version of Visual MINTEQ ver 3.0 for use in this course: http://www2.lwr.kth.se/english/OurSoftWare/Vminteq/index.html

Campus Helping Resources
Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. The Counseling and Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling and Wellness Center, 3190 Radio Road, 392-1575, www.counsel.ufl.edu
  - Counseling Services
  - Groups and Workshops
  - Outreach and Consultation
  - Self-Help Library
- Training Programs
- Community provider database

**Career Resource Center, CR-100 JWRU, 392-1601, www.crc.ufl.edu/**

**Students with Disabilities**
The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues.

The University of Florida is committed to providing academic accommodations for students with disabilities. Students with disabilities requesting accommodations should first register with the Dean of Students Office (0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. The University encourages student with disabilities to follow these procedures **as early as possible** within the semester.

**Attendance Policies** – see https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx for UF policies on absences, religious holidays, illness, and the 12-day rule. The instructor expects you to be present in all classes, but realizes that life is not always predictable. Talk with the instructor regarding anticipated and unexpected absences.
## TOPIC OUTLINE

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<th>TOPICS</th>
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<th>#s LECTURES**</th>
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<td><strong>Introduction/Overview</strong></td>
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<td>4 = 8/27, 8/29, 9/3</td>
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<td>Soil and Water Chemistry</td>
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<td>10 = 9/8, 9/10, 9/12, 9/15, 9/17, 9/19, 9/22, 9/24, 9/26</td>
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<td><strong>MEE Ch 5 &amp; 6; DLS Ch 4</strong></td>
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<td>Soil Solid Phases</td>
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<td>Sorption Phenomena</td>
<td><strong>SBO Ch 10 &amp; 11;</strong></td>
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<td><strong>Parker Reading</strong></td>
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Chemistry of Acid Soils
Development of acidity
Aluminum and trace element chemistry
Neutralization of acidity

Chemistry of Saline and Sodic Soils/Waters
Characteristics
Soil impacts
Reclamation/management

Thanksgiving Break, No Class 11/26-11/28

Redox Chemistry of Soils
Redox potentials
Eh vs pH and pe vs pH
Applications

Makeup/Review

Exam # 3 (Final), 12/17 @ 3:00 pm

SBO = Strawn, Bohn, and O’Connor; MEE = M.E. Essington; DLS = D.L. Sparks texts – see reading list.

**Approximate** number of lectures and dates; topics towards the end of the outline, in particular, may not be covered in the detail indicated, and the order of topic coverage may change.