UNIVERSITY OF CALIFORNIA, MERCED
ENVE 184 – Field Methods in Environmental Chemistry (2 units)
Fall 2018
GRAN 155, M 1:30-3:20 pm

Instructor: Marc Beutel; SE1 210; mbeutel@ucmerced.edu
Office Hours: Formal time to be announced, or by appointment

I. Course Description: The course will focus on assessing the environmental chemistry of nutrients (phosphate, nitrate and ammonia) and metals (iron and manganese) in the context of chemical cycling at the sediment-water interface of surface water reservoirs. These chemicals can degrade water quality and treatability of raw water for potable use. A focus of the course will be understanding how dissolved oxygen concentration and oxidation-reduction potential ("redox") affect the sediment release of these chemicals to overlaying water. The first half of the course includes lectures related to the chemical cycling and analysis of nutrients and metals. In the second half of the course, students will break into four teams focusing on one chemical of interest (phosphorus, nitrogen, iron and manganese). Students will collect water samples down the water column of San Pablo Reservoir, a large raw water reservoir near Berkeley, California. The students will analyze the samples for phosphate and nitrate using ion chromatography, for ammonia using colorimetric analysis, and for iron and manganese using inductively coupled plasma. Students will also take a tour of the San Pablo water filtration plant and meet with environmental professionals engaged with protecting water quality in San Pablo Reservoir. At the end of the course, students will submit an individual project report and give a final team presentation.

II. Course Goals and Outcomes:

a. ***Course Goals:*** The general goals of this course are tied to the educational objectives of the Environmental Engineering program at UC Merced. The first goal is to enhance student's fundamental knowledge of environmental chemistry through application of basic math, science and engineering principles. The second goal is to enhance student's critical thinking skills through the application of engineering principles and reasoning to solve water quality related problems. The third goal is to enhance basic design skills of students in the context of designing an experiment to assess chemical cycling at the sediment-water interface and developing management strategies to protect water quality in water reservoirs. Students will achieve these goals through a rigorous program of lectures, reading, laboratory work, field trips, writing, and oral presentations.

b. ***Learning Outcomes:*** Specific learning outcomes are listed below. By the end of this course, you will be able to:
- Describe the water quality implications of key environmental chemicals (nutrients and metals) in surface water reservoirs.
- Describe the redox-related cycling of key environmental chemicals (nutrients and metals) at the sediment-water interface of reservoirs.
- Describe spatial and temporal patterns of temperature, dissolved oxygen, nutrients and metals in reservoirs.
- Collect, preserve and analyze environmental water samples for nutrients and metals.
- Analyze and interpret water quality data.
- Develop and apply effective teamwork, written, oral and graphical communication skills.
- Describe the treatment train for a potable water treatment plant.
- Design a laboratory experiment to quantify sediment release of key environmental chemicals (nutrients and metals).
- Develop a preliminary design for a reservoir water quality management strategy.

III. Course Format: The first half of the course is structured as interactive lectures in which material is presented in real time on the board, with students being asked to help explain and interpret the lecture material. Lectures will be supplemented with PowerPoints of key figures and tables from the text book. Students are strongly encouraged to ask questions during lectures and share any insights or appropriate comments they may about the lecture material. Course material will be made available in a timely manner via CatCourses. The second half of the course will focus on students performing water quality analyses at the UC Merced Environmental Analyses Laboratory and developing their individual reports and team presentations.

The course is partly structured around the text book Limnology (Horne and Goldman, 1994), so it is important that students have the text book. In addition, there will be supplemental reading material including reports, journal papers and analytical methods. It is critical that students do assigned reading before lectures. Reading is needed to prepare for daily questions, a set of questions that students will be randomly asked during lecture.

It is important for students to engage with the course material by taking notes (i.e., copying down what is put on the board and what is said by the professor and students) as the lectures unfold. Finally, work load expectations are around 2 hours per week per course unit outside of class. Thus you are expected to study at least 4 hours per week outside of class time for this 2 unit course.

Note there will be a mandatory all-day field sampling trip, tentatively scheduled for Monday, October 1, to San Pablo Reservoir near Berkeley, California. Transportation will be provided.

IV. Course Requirements:

a. ***Class attendance and participation policy:*** Your active participation during lecture is a critical component of the course and is important to both its success and your ability to learn course material. To optimize your learning effectiveness, it is critical that you take detailed notes during lecture as we develop and discuss course material on the board. Your discussions in class, your response to daily questions, your note taking activities, and your attendance will be recorded. Course participation will be worth 20% of your grade. The following rubric will be used to assess your level of participation in the course:
   - Excellent (A): Regularly makes thoughtful and appropriate contributions to discussions that seek to broaden understanding and application of material. Actively taking detailed notes and engaged in lectures. Minimal absences.
   - Good (B): Occasionally makes thoughtful and appropriate contributions to discussions that seek to broaden understanding and application of material. Actively taking detailed notes and engaged in lectures. Occasional absences.
   - Fair (C): Infrequently makes contributions to discussions with only a basic attempt to broaden understanding and application of material. Taking some notes and passive engagement with lectures. Modest number of absences.
   - Poor (D/F): Almost never makes contributions to discussions with superficial or off-topic comments that do not broaden understanding and application of material. Taking no notes and not engaging with lectures. Frequent absences.

b. ***Course textbook:*** Limnology 2nd Edition (Horne and Goldman, 1994, McGraw-Hill), Perform the assigned reading before lectures and in consultation with the daily questions so that you are prepared to answer the daily questions in class.

c. ***Course assignments and projects:*** Course assignments and projects include: (i) daily questions, (ii) exam, (iii) individual project report, and (iv) team presentation. These are outlined below.

- Daily Questions (DQs) related to upcoming lecture topics will be distributed to the class prior to lectures. DQs are meant to help students understand what material in the text to focus on, as well as prepare for lectures and exams. During lecture, random students will be asked to address DQs and the quality of responses will be recorded and applied to your course participation grade.
- The course includes a mid-term exam. Students will be allowed one page of notes for each exam (8 ½ inches by 11 inches). Students are expected to take all exams at the scheduled time. Failure to do so will result in an exam score of zero.
- Students will each submit a ~10 page project report at the end of the semester. The report will focus on one of four key pollutants (phosphorus, nitrogen, iron or manganese), but will also present an integrated picture of chemical cycling in San Pablo Reservoir. The report will also propose a design for an experimental chamber study to assess chemical cycling at the sediment-water interface and present a potential in-reservoir management strategy to improve water quality in the reservoir.
- Students will break into four teams (phosphorus, nitrogen, iron or manganese) and make a team presentation (~20 minutes long) at the end of the course. The presentation will cover the same key themes as the individual project report including: (1) focusing on one pollutant; (2) presenting an integrated picture of chemical cycling in San Pablo Reservoir; (3) designing an experimental chamber study to assess chemical cycling; and (4) presenting a potential in-reservoir management strategy to improve water quality.

V. Grading Procedures: Final grades will be estimated based on the following breakdown: class participation, 10%; exam, 40%; individual project report, 30%; group presentation, 20%. Final grades will be assigned on the following standard scale. I may adjust the scale accordingly at the end of the semester to ensure that an appropriate allocation of grades is obtained.

97 to 100	A+	87 to 89.9	B+	77 to 79.9	C+	60 to 66.9	D
93 to 96.9	A	83 to 86.9	B	73 to 76.9	C	below 60	F
90 to 92.9	A-	80 to 82.9	B-	70 to 72.9	C-		

VI. Academic Integrity:

a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.

b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an electronic or hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

VII. Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities

based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

VIII. **Tentative Course Schedule**: See the following page for a detailed course schedule. The schedule is subject to change.

IX. **Commercial Use of Course Materials.** All course materials are my intellectual property and are protected by copyright. Selling course material or notes through commercial services, without my written advance permission, may be viewed as copyright infringement and/or an academic integrity violation.

ENVE 184 Fall 2018 - Course Schedule

Week	Lecture Topic	Daily Question	Comments and Reading
Week 1 Aug 27	Course introduction; Introduction to limnology	DQ1	Limno Ch 2 & 6; Beutel et al. (2010)
Week 2 Sep 3	Labor Day Holiday		No Class
Week 3 Sep 10	Dissolved oxygen and temperature; Redox	DQ2	Limno Ch 4 & 7; Redox Chapter
Week 4 Sep 17	Nutrient cycling in lakes	DQ3	Limno Ch 8, 9 & 20; Beutel (2006)
Week 5 Sep 24	Iron and manganese cycling in lakes	DQ4	Limno Ch 10; Davison (1993)
Week 6 Oct 1	Monitoring field trip to San Pablo Reservoir near Berkeley, California		ALL DAY FIELD TRIP
Week 7 Oct 8	Analytical methods; LDO sensors; Colorimetric analysis; Ion chromatography; Inductively coupled plasma	DQ5	LDO Presentation; Method 350.1; Short Ammonia Method; Method 4110; Method 3125 https://www.youtube.com/watch?v=1htwabbOmMc https://www.youtube.com/watch?v=noUSORH5JWo https://www.youtube.com/watch?v=p3_WtEYIhTo https://www.youtube.com/watch?v=biE8smiLx-8
Week 8 Oct 15	Experimental sediment chamber incubations; Lake Oxygenation	DQ6	Beutel et al. (2008); San Pablo Flux Study; Beutel and Horne (1999); Devils Lake Report
Week 9 Oct 22	**Exam**		
Week 10 Oct 29	Ammonia analysis (colorimetric)		Method 350.1; Short Ammonia Method https://www.youtube.com/watch?v=noUSORH5JWo
Week 11 Nov 5	SETAC Conference in Sacramento		No Class
Week 12 Nov 12	Veterans Day Holiday; Iron and manganese analysis (inductively coupled plasma)		No Class Monday; Analysis efforts Tuesday-Friday Method 3125 https://www.youtube.com/watch?v=biE8smiLx-8
Week 13 Nov 19	Nitrate and phosphate analysis (ion chromatography)		Analysis efforts Monday-Tuesday Method 4110 https://www.youtube.com/watch?v=p3_WtEYIhTo
	Thanksgiving Break, Nov 21-23		
Week 14 Nov 26	Data analysis; Report and presentation develoment		
Week 15 Dec 3	**Team presentations; Individual project reports due**		