3 Sept 2013

Graduate Committee on Curriculum and Special Programs
College of Charleston

I support the proposal by Dr. Vijay Vulava to change the number of credits from 3 to 4 by adding a laboratory section to EVSS 631 “Pollution in the Environment” and to change the description to better reflect the broader scope and appeal of this course. We welcome Dr. Vulava’s efforts to expand this lecture-only course to include a laboratory section and provide students opportunities for experiential learning and applied science projects. This will serve students in their environmental studies career.

Attached is the course proposal form and a syllabus.

Sincerely,

Tim Callahan
Contact Name: Vijay M. Vulava  
Email: vulavav@cofc.edu  
Phone: 31922

Department Name: Geology and Environmental Geosciences  
Graduate Program Name: MES

Course Prefix, Number, and Title: EVSS 631 Pollution in the Environment

I. CATEGORY OF REVIEW (Check all that apply)

<table>
<thead>
<tr>
<th>NEW COURSE</th>
<th>CHANGE COURSE</th>
<th>DELETE COURSE</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ New Course</td>
<td>□ Change Number (IV, VII, VIII, IX)</td>
<td>□ Delete Course (IV, VII, IX)</td>
<td></td>
</tr>
<tr>
<td>(attach syllabus*)</td>
<td>□ Change Title (IV, VII, VIII, IX)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Change Credits/Contact hours (II, IV, VII, IX)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Prerequisite Change (IV, VII, VIII, IX)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Edit Description (III, IV, VII, VIII, IX)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

☐ Approve for Cross-listing (attach Graduate Permission to Cross-list Form)

Date (Semester/Year) the course will first be offered, course changes or deletion will go into effect: Fall 2014

NEW COURSE:

*ATTACH THE SYLLABUS FOR A NEW GRADUATE COURSE to include:

- Course description and objectives
- Method of teaching (e.g., lecture, seminar, on-line, hybrid)
- Required and optional texts and materials
- Graduate School Grading Scale
- Assignments, student learning outcomes and assessment components
- Policies to include attendance, Honor Code, American Disabilities Act statement
- Tentative course schedule with specific topics
List prerequisites and / or other restrictions below

CHEM 111 and CHEM 112 or equivalent; or permission of the instructor.

Will this course be added to the Degree Requirements?

a) ☒ Yes  ☐ No

b) If yes, explain

This course is already one of the four core science classes offered within the MES program. The change reflects a new laboratory component added to the existing class.

II. NUMBER OF CREDITS and CONTACT HOURS per week

<table>
<thead>
<tr>
<th></th>
<th>Lecture</th>
<th>Lab</th>
<th>Seminar</th>
<th>Ind. Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Contact Hours</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Credit Hours 4 0

Is this course repeatable? ☐ yes ☒ no If so, how many credit hours may the student earn in this course?

III. CATALOG DESCRIPTION Limit to 50 words EXACTLY as you want it to appear in the catalog; include prerequisites, co-requisites, and other restrictions. If changing course description, please include both old and new course descriptions.

OLD:
Multidisciplinary study of fundamental physical, chemical, and biological processes that affect transport and fate of human-induced and natural pollutants in the environment. This course is for students who have strong interests in environmental sciences, with basic preparation in sciences such as chemistry, geology, and/or biology.

NEW:
Course focuses on theoretical and quantitative skills required to assess how natural and anthropogenic factors influence pollutant behavior in Earth's near-surface environments, including fresh water and soils. Laboratory focuses on assessing pollutants in various environmental media using appropriate analytical techniques. Lecture three hours per week; laboratory three hours per week.
IV. RATIONALE / JUSTIFICATION: If course change – please indicate the course change details. If course change or deletion—please provide reasons for change(s) to or deletion of a course. If a new course—briefly address the goals/objectives for the course and the relationship to the strategic plan.

I have changed the course description to be more specific with respect to the course content. I am also adding an additional credit hour (3 contact hours/week) for the new laboratory component to give students more experiential and applied training in the lab and the field to go with the theoretical aspects covered in the lecture.

The new component will also help students conduct a hands-on assessment of an environmental contamination problem and communicate those results in a professional manner.

V. STUDENT LEARNING OUTCOMES and ASSESSMENT

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Assessment Method and Performance Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>What will students know and be able to do when they complete the course?</td>
<td>How will each outcome be measured? Who will be assessed, when, and how often? How well should students be able to do on the assessment?</td>
</tr>
<tr>
<td>1. Possess a solid understanding of environmental processes and pollutant behavior in the environment</td>
<td>Measured based on student performance in several quantitative and qualitative problem solving exercises assigned during the semester. Students should be able at a minimum to perform 70% on assignments and tests for each module.</td>
</tr>
<tr>
<td>2. Possess the requisite skills to apply theoretical knowledge to solve environmental problems</td>
<td>Measured based on student performance in several quantitative and qualitative problem solving exercises assigned during the semester. Students should be able at a minimum to perform 70% on assignments and tests for each module.</td>
</tr>
<tr>
<td>3. Know how to make quantitative predictions about outcomes of chemical reactions that occur in context of geological processes</td>
<td>Measured based on student performance in several quantitative and qualitative problem solving exercises assigned during the semester. Students should be able at a minimum to perform 70% on assignments and tests for each module.</td>
</tr>
<tr>
<td>4. Effectively present research results in both written and oral formats</td>
<td>2 methods: a) Lead a case study discussion and presentation. b) Conduct a lab-based research project and present results from their project as a research paper and as a presentation. Students will be able to successfully communicate concepts in written and oral format (assessed using grading rubrics).</td>
</tr>
</tbody>
</table>

Note: Qualitative assignments are graded using rubrics. Quantitative assignments are graded based on accuracy of approach and solution to the problem.
VII. IMPACT ON EXISTING PROGRAMS and COURSES: Please briefly document the impact and expected changes of this new/changed/deleted course on other departments, programs and courses; if deleting a course—list all departments and programs that include the course; if adding/changing a course—explain any overlap with existing courses in the same or different departments; if adding or deleting a course that will be part of a joint program identify the partner institution.

This course is cross-listed with GEOL 441: Pollution in the Environment (course name changed from Aqueous Environmental Geochemistry – name change proposal in review). Because of the nature of the course there is strong interest among both upper-level geology undergraduate students and Master of Science in Environmental Studies students for this course. To increase likelihood of the course attracting a viable number of students each time the course is offered, a resource-sharing approach will be taken in which the two student populations will receive instruction by the faculty, but the M.S. students will be expected to perform more complex learning outcomes and have a greater workload than the undergraduate students. Interaction between the two groups will increase the diversity and productivity of class discussions.

VIII. COSTS ASSOCIATED WITH THE ACTION REQUESTED: List all of the new costs or cost savings, (including new faculty/staff requests, library or equipment, etc.) associated with the action requested. New courses requiring additional resources will need special justification.

As with all lab-based science courses, there will be a standard lab fee associated with this course. There are no other new resources required.
IX. APPROVAL AND SIGNATURES

Signature of Program Director: 

Date: 9/3/13

Signature of Department Chair: 

Date: 9/8/13

Signature of Additional Chair*: 

Date: 

Signature of Schools’ Dean: 

Date: 9/11/2012

Signature of Additional Schools’ Dean*: 

Date: 9/12/13

Signature of the Provost: 

Date: 9/29/13

Signature of Budget Director/Business Affairs Office: 

Date: 9-30-13

*For interdisciplinary courses

Return form to the Graduate School Office for Further Processing

Signature of Chair of the Faculty Committee on Graduate Education, Continuing Education & Special Programs: 

Date: 10/18/13

Signature of Chair of the Graduate Council: 

Date: 10/18/13

Signature of Faculty Senate Secretary: 

Date: 

Date Approved by Faculty Senate: 

September 2011
GRADUATE PERMISSION TO CROSS-LIST FORM

This form must ALWAYS be accompanied by a graduate COURSE FORM.

Contact Name: Vijay M. Vulava  Email: vulavav@cofc.edu  Phone: 3-1922
Tim Callahan, MES Director (callahant@cofc.edu)

Department and School Name: Geology and Environmental Geosciences
Name and Acronym of Graduate Program: Master of Science in Environmental Studies (MES)

Date (Semester/Year) cross-listing will take effect: Fall 2014

I. CATEGORY OF REVIEW (Check all that apply)

☐ New Course -- Course Number/Title
☒ Existing Course -- Course Number/Title EVSS 631
☐ Special Topic Course -- Course Number/Title

This course will be cross-listed with an
☒ undergraduate course (complete sections II, III, and IV below)
☐ existing graduate course (complete section IV below)

II. CURRICULUM DIFFERENCES—UNDERGRADUATE AND GRADUATE LEVELS

Please submit separate syllabi for both graduate and undergraduate courses

Syllabi for both undergraduate and graduate courses are attached  ☒ YES  ☐ NO

Explain the differences between the syllabi in terms of requirements, learning objectives and course content

GEOL 441/441L is an elective course that appeals to Geology and other majors interested in the Environmental Geology track, and the course serves as training for future career work in environmental consulting, natural resources management, as well as preparation for graduate study.

EVSS 631/631L is one of four courses that satisfies the Core Environmental Sciences requirement in the Master of Science in Environmental Studies program. The course content provides the knowledge base and training, and the course structure emphasizes leadership skills, in which the graduate students act as team leaders and mentors in group projects for which they help train and direct undergraduate students.

The content of the course in the first half of the semester is the same for both groups, but the focus in the second half is on original research projects for the graduate students and application of the instructor's research ideas for undergraduate projects.
III. APPROVAL SECTION – GRADUATE COURSE WITH UNDERGRADUATE COURSE

Undergraduate Course Number / Title GEOL 441/441L: Pollution in the Environment

Names and Signatures:
Name of Department Chair of the Graduate Course: Mitchell W. Colgan
Signature _______________________________ Date: 9/26/13

Department Chair of the Undergraduate Course: Mitchell W. Colgan
Signature _______________________________ Date: 9/26/13

Graduate Program Director: Timothy J. Callahan
Signature _______________________________ Date: 9/26/13

Provost
Signature _______________________________ Date: __________________

IV. APPROVAL SECTION – GRADUATE COURSE WITH EXISTING GRADUATE COURSE

Graduate Course Number / Title of Existing Graduate Course

Program(s) of Existing Graduate Course

Names and Signatures:
“Host” Program Director
Signature _______________________________ Date: __________________

“Requesting” Program Director
Signature _______________________________ Date: __________________

Provost
Signature _______________________________ Date: __________________

Return form to the Graduate School Office for Further Processing
Signature of Chair of the Faculty Committee on Graduate Education, Continuing Education & Special Programs:

_________________________________________ Date: __________________

Signature of Chair of the Graduate Council:

_________________________________________ Date: __________________

Signature of Faculty Senate Secretary:

_________________________________________ Date: __________________

Date Approved by Faculty Senate: ________________________________
Pollution in the Environment
Fall 2013 Syllabus
Instructor: Dr. Vijay M. Vulava

1 Contact Information

Office: RHSC 336, MF 13:30-16:00 h (or by appoint.)
Lecture: RHSC 344, MWF 12:00-12:50 h
Laboratory: RHSC 330/341, W 14:00-17:00 h
Phone: 843.608.9628
Email: vulavav@cofc.edu
Lectures, readings, & links: “OAKS” on http://my.cofc.edu/

2 Course Goals and Structure

This course focuses on theoretical skills required to understand how natural and anthropogenic factors influence pollutant behavior on Earth’s near-surface environments. We will primarily focus on fresh water (i.e. streams, lakes, and groundwater) and shallow geological environments (soils and sediments).

Since this may be the only environmental chemistry-themed course you may take at the College, it is a broad survey course and will cover a lot of topics. Paradoxically, you will find that “environmental pollution” is so broad, that we barely touched a fraction of all aspects of this topic in this course. You will, however, have the opportunity to pursue and research topics related to pollution in detail on your own over the course of this class. Some examples of case studies/topics that could be covered are shown in Figure 1. Depending on your interests more cases could be studied.

This course will take a quantitative approach to understanding environmental pollution issues. Over the course of the semester, you will also be introduced to tools such as (i) PHREEQC, a very powerful hydrogeochemical modeling tool (http://www.cr.usgs.gov/projects/GWC/coupled/phreeqc/), (ii) Visual MINTEQ, a visual chemical equilibrium model (http://www2.lwr.kth.se/English/OurSoftware/vminteq/), (iii) Wolfram Alpha, a very powerful visual mathematics programming language (http://www.wolframalpha.com/), (iv) Excel, to solve and visualize equilibrium chemical problems, (v) \LaTeX\ 2\alpha, an intelligent and very powerful scientific text-typesetting program (http://latex-project.org/intro.html).

Some of you may be uncomfortable with your arithmetic, geology, and chemistry skills – I assure you that most of you are in the same boat. Just be open to learning lots of new concepts and don’t stress out – environmental chemistry and sciences are more fun than you can imagine!

Unlike most other science courses you have in Environmental Studies and Geology this course is a bit different in two regards:

1. A case study approach: The traditional approach of top-down incremental knowledge approach seems too contrived for this kind of a class. Instead, this class takes an unstructured case study approach to understanding environmental pollution issues. This approach will help you focus on the “big picture” and develop a context for using basic science concepts to understand how environments work. As you try to unravel specific environmental pollution issues, you will learn core science skills necessary to understand and predict outcomes in similar situations. Since this is a significantly different approach than what you probably see in other classes, I expect all of you to fully participate and give me periodic feedback on
what is working and what isn’t. I will gratefully accept and welcome all comments (positive and negative) and will attempt to incorporate any changes necessary to make your learning experience successful. I expect you to be a full partner in this course.

2. No examinations: One of the main goals of this course is to enhance your understanding of environmental pollution issues and be able to both qualitatively and quantitatively predict various outcomes. This requires critical thought and practice in both group settings and in individual settings. A traditional way to test your understanding is to have an exam and test your competence, but this is not the best approach for this course. Hence, there will be no exams (or a final exam) in this class, instead, there will be group and solo problem-solving activities and assignments. There will be several collaborative opportunities in this class on research and problem-solving activities.

For the laboratory component of this course, attendance is mandatory as these labs are hard to make up if missed (some of these are field trips.) The first half of the semester, you will learn basic environmental analytical techniques and familiarize yourselves with advanced instrumentation. You will hand in brief reports (up to 1500 words including figures and data tables) that contain critical analysis of the experiments conducted. The second half of the semester will focus on your lab-based projects at the end of which you will turn in a 5000-word paper (including references, figures, and tables.)

There will be two field trips during the semester that would require more than the allocated class time. Hence, plan on spending 3-4 h during two weekends to attend these field trips. Two of these trips will focus on conducting water quality surveys in Filbin Creek, North Charleston and another to Shem Creek in Mt. Pleasant. If you have other ideas for potential field trips, let me know in advance. On these trips you will have hands-on opportunities to learn about techniques
that are used to assess basic environmental parameters in the field.

Since this class is about the environment and ultimately related to sustainable practices, we'll limit use of paper as much as possible. Upload all your assignments and project reports in MS Word (PC format) or PDF format to your Google Drive account. Create a folder on your Drive account and share that account with me. I encourage you to learn how to use the free \LaTeX\ software to create your documents. This software allows you to easily typeset complex equations, tables, figures, tables of content, bibliography, etc. while you focus on content of your document. \LaTeX\ is free and is available for PC, Mac, and Linux platforms (http://latex-project.org/ftp.html). If you bring your laptop, I can help you set up the software. I will show you how to create simple \LaTeX\ documents.

3 Learning Outcomes:

On successful completion of this course, you will:
1. develop a solid understanding of environmental processes and pollutant behavior in the environment,
2. develop the requisite skills to apply you theoretical knowledge to solve environmental problems,
3. know how to make quantitative predictions about outcomes of chemical reactions that occur in context of geological processes, and
4. be able to work independently and effectively present research results in both written and oral formats.

4 Prerequisites

This course is designed for students that have had a two-course sequence of chemistry (CHEM 111 and 112) and college level introductory math courses. Students that are deficient can also do well in this course, provided they spend additional time getting up to speed with basic principles. Simple arithmetic is used throughout this class (logarithms, manipulating and solving simultaneous equations, etc.), so if you're out of practice, either look up basic math (Math 101/102) textbooks or come and see me if you need additional help.

5 Textbooks

There is no required textbook for this class. All required readings will come from journal articles, textbook chapters, and other sources. These readings or links to sources will be made available as PDFs on OAKS.


Required Reading for Class: M. Davis and S. Masten. 2013. Principles of Environmental Engineering & Science. Chapters from this book will be posted on OAKS.

Reference Text: Werner Stumm and J.J. Morgan. 1996. Aquatic Chemistry (Paperback), 3rd Ed., 1040 pp., Wiley. The BIBLE of aqueous chemistry - there is no better reference book than this. Includes several practice and worked problems and also in-depth coverage of several topics. You can borrow from my personal library.


6 Tentative Class Schedule and Deadlines

<table>
<thead>
<tr>
<th>Dates</th>
<th>Lecture Topics</th>
<th>Event and Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/21-8/23</td>
<td>Introduction</td>
<td>9/6, Outline &amp; abstract due</td>
</tr>
<tr>
<td>8/26-8/30</td>
<td>Cr contamination</td>
<td></td>
</tr>
<tr>
<td>9/2-9/6</td>
<td>Chemical concepts</td>
<td></td>
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<tr>
<td>9/9-9/13</td>
<td></td>
<td></td>
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<td>9/16-9/20</td>
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<td></td>
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<tr>
<td>9/23-9/27</td>
<td>Soils/groundwater</td>
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<tr>
<td>9/30-10/4</td>
<td></td>
<td></td>
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<tr>
<td>10/7-10/11</td>
<td>As contamination</td>
<td>10/11, Project proposal due</td>
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<tr>
<td>10/16-10/18</td>
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<td>10/14 - Fall Break</td>
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<tr>
<td>10/21-10/25</td>
<td>A Civil Action/TCE contamination</td>
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<tr>
<td>10/28-11/1</td>
<td></td>
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<tr>
<td>11/4-11/8</td>
<td>Climate change/Ocean acidification</td>
<td>Thanksgiving Week</td>
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<td>11/11-11/15</td>
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<tr>
<td>11/18-11/22</td>
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<td></td>
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<tr>
<td>11/25</td>
<td>Research presentations</td>
<td>Final paper due</td>
</tr>
<tr>
<td>12/2</td>
<td>Research presentations</td>
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</tr>
</tbody>
</table>

7 Student Expectations

I expect all of you to have working knowledge of basic sciences (biology, physics, and/or chemistry) and basic math, including algebra. If you feel deficient, you will take the opportunity to brush up on some basics as required. Since you are in graduate school, I also expect that you have some experience in writing papers and making oral presentations in front of peer audiences. If your experiences are limited, then this is a course that requires you to polish up some skills. You are also expected to participate or lead a group projects or be able to work independently as required.
I don’t expect anyone to fail in this class, but, you need to put in some effort! Class attendance is most important part of this class and you may not do well if you miss classes. All deadlines will be strictly enforced, unless you have a very good excuse (death in family, contagious illness, etc., but being stressed out, etc. are not good excuses.)

8 Evaluation

You performance in this course will be assessed based on your understanding of basic environmental pollution concepts and the demonstration of your ability to apply this knowledge. This will involve a combination of (i) group problem-solving exercises – you will work in groups or by yourself, (ii) solo problem-solving exercises, (iii) paper and presentation associated with your research projects and case studies, and (iv) class participation.

1. Group problem-solving exercises will include solving problems and synthesis and interpretation of published data - there will be 6-7 of these - 20% of total grade. Notes: All students in the group get identical grade and hence it is important to work well together. Note that it is not necessary to work in a group, but, it is strongly encouraged. In some cases, I’ll pre-assign groups and all students within the group will have to work together. I’ll clearly specify if the exercise can be worked as a group assignment.

2. Solo problem-solving exercises include similar problems as above - there will be about 5-6 exercises total – 30% of total grade.

3. Brief, but in-depth, pollution case studies in areas that I do not plan to cover or of specific interest to you. This will be a small group (3-4 students) exercise. Each self-selected group identifies appropriate research papers ahead of time and shares these papers with entire class and then leads a discussion of 15-min each. Two of these exercises over the semester – 10% of total grade (entire group gets same grade.)

4. A 5000-word lab-research paper that is comprehensive and original in scope and takes a good look at specific aspect of a pollution related topic. Come and see me before you create an outline to discuss your topic. Use the journal “Environmental Pollution” as a model for your paper (see http://bit.ly/qyZNhg for instructions on preparing the project report in a manuscript form) – 30% of total grade. Notes: Grade includes grades for all aspects of the paper, including the outline, the draft, and the final paper. Check course schedule for deadlines. I will provide detailed formatting and grading criteria over the next few weeks.

5. A 15 minute presentation of your project to the class during last week of class – 10% of total grade. Grading rubric will be provided over the last third of the semester.

6. Laboratory grade is separate from the lecture grade and will be based on lab reports (70%), lab journals (15%), and the quality of lab work (15%). Weekly projects are collaborative efforts, but each of you will synthesize and submit your own reports. Formatting instructions and grading criteria will be provided during first lab period.

The grade you earn by the end of the semester will be based on this scale: Excellent (A), Good (B+), Fair (B), Poor (< B)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
</tr>
<tr>
<td>B+</td>
<td>92-87</td>
</tr>
<tr>
<td>C+</td>
<td>80-75</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 70</td>
</tr>
<tr>
<td>B</td>
<td>86-81</td>
</tr>
<tr>
<td>C</td>
<td>74-70</td>
</tr>
</tbody>
</table>

9 Course Product (or What you will get from this course)

On successful completion of this course, you will be able to

- Critically understand processes related to environmental contamination
• Interpret the behavior of naturally complex environmental systems
• Critically analyze environmental data and explain your findings and conclusions to your peers
• Integrate various basic sciences (chemistry, biology, geology, etc.) and mathematical skills to solve multidisciplinary problems
• Collaboratively develop research projects
• Develop other ancillary skills:
  – Become familiar with journals and technical sources in subject area
  – Become proficient in conducting literature reviews
  – Improve your presentation and science writing skills
  – Learn how to use software (Excel, LaTeX, etc.) to analyze, visualize, and present chemical/physical data.

10 CofC’s Honor Code and Academic Integrity

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines the student’s actions are clearly related more to a misunderstanding will handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed by both the instructor and the student will be forwarded to the Dean of Students and placed in the student’s file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student’s transcript for two years after which the student may petition for the X to be expunged. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration—working together without permission—is a form of cheating. Unless the instructor specifies that students can work together on an assignment and/or test, no collaboration is permitted. Other forms of cheating include possessing or using an unauthorized study aid (such as an iPhone or other smartphones), copying from others’ exams, fabricating data, and giving unauthorized assistance.

Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor.

1 Contact Information

Office: RHSC 336, MF 13:30-16:00 h (or by appoint.)
Lecture: RHSC 344, MWF 12:00-12:50 h
Laboratory: RHSC 330/341, W 14:00-17:00 h
Phone: 843.608.9628
Email: vulavav@cofc.edu
Lectures, readings, & links: "OAKS" on http://my.cofc.edu/

2 Course Goals and Structure

This course focuses on theoretical skills required to understand how natural and anthropogenic factors influence pollutant behavior on Earth’s near-surface environments. We will primarily focus on fresh water (i.e. streams, lakes, and groundwater) and shallow geological environments (soils and sediments).

Since this may be the only one or two environmental chemistry-themed course you may take at the College, it is a broad survey course and will cover a lot of topics. Paradoxically, you will find that “environmental pollution” is so broad, that we barely touched a fraction of all aspects of this topic in this course. You will, however, have the opportunity to pursue and research topics related to pollution in detail on your own over the course of this class. Some examples of case studies/topics that could be covered are shown in Figure 1. Depending on your interests more cases could be studied.

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Unlike most other science courses you have in Environmental Studies and Geology this course is a bit different in two regards:

1. A case study approach: The traditional approach of top-down incremental knowledge approach seems too contrived for this kind of a class. Instead, this class takes an unstructured case study approach to understanding environmental pollution issues. This approach will help you focus on the “big picture” and develop a context for using basic science concepts to understand how environments work. As you try to unravel specific environmental pollution issues, you will learn core science skills necessary to understand and predict outcomes in similar situations. Since this is a significantly different approach than what you probably see in other classes, I expect all of you to fully participate and give me periodic feedback on
what is working and what isn’t. I will gratefully accept and welcome all comments (positive and negative) and will attempt to incorporate any changes necessary to make your learning experience successful. I expect you to be a full partner in this course.

2. **No examinations:** One of the main goals of this course is to enhance your understanding of environmental pollution issues and be able to both qualitatively and quantitatively predict various outcomes. This requires critical thought and practice in both group settings and in individual settings. A traditional way to test your understanding is to have an exam and test your competence, but this is not the best approach for this course. Hence, there will be no exams (or a final exam) in this class, instead, there will be group and solo problem-solving activities and assignments. There will be several collaborative opportunities in this class on research and problem-solving activities.

For the laboratory component of this course, attendance is mandatory as these labs are hard to make up if missed (some of these are field trips.) The first half of the semester, you will learn basic environmental analytical techniques and familiarize yourselves with advanced instrumentation. You will hand in brief reports (up to 1500 words including figures and data tables) that contain critical analysis of the experiments conducted. The second half of the semester will focus on your lab-based projects at the end of which you will turn in a 4000-word paper (including references, figures, and tables.)

There will be two field trips during the semester that would require more than the allocated class time. Hence, plan on spending 3-4 h during two weekends to attend these field trips. Two of these trips will focus on conducting water quality surveys in Filbin Creek, North Charleston and another to Shem Creek in Mt. Pleasant. If you have other ideas for potential field trips, let me know in advance. On these trips you will have hands-on opportunities to learn about techniques
that are used to assess basic environmental parameters in the field.

Since this class is about the environment and ultimately related to sustainable practices, we'll limit use of paper as much as possible. Upload all your assignments and project reports in MS Word (PC format) or PDF format to your Google Drive account. Create a folder on your Drive account and share that account with me. I encourage you to learn how to use the free \texttt{\LaTeX} 2e software to create your documents. This software allows you to easily typeset complex equations, tables, figures, tables of content, bibliography, etc. while you focus on content of your document. \texttt{\LaTeX} 2e is free and is available for PC, Mac, and Linux platforms (http://latex-project.org/ftp.html). If you bring your laptop, I can help you setup the software. I will show you how to create simple \texttt{\LaTeX} 2e documents.

3 Learning Outcomes:

On successful completion of this course, you will:

1. develop a solid understanding of environmental processes and pollutant behavior in the environment,
2. develop the requisite skills to apply you theoretical knowledge to solve environmental problems,
3. know how to make quantitative predictions about outcomes of chemical reactions that occur in context of geological processes, and
4. be able to work in small teams and effectively present research results in both written and oral formats.

4 Prerequisites

This course is designed for students that have had a two-course sequence of chemistry (CHEM 111 and 112) and college level introductory math courses. Students that are deficient can also do well in this course, provided they spend additional time getting up to speed with basic principles. Simple arithmetic is used throughout this class (logarithms, manipulating and solving simultaneous equations, etc.), so if you’re out of practice, either look up basic math (Math 101/102) textbooks or come and see me if you need additional help.

5 Textbooks

There is no required textbook for this class. All required readings will come from journal articles, textbook chapters, and other sources. These readings or links to sources will be made available as PDFs on OAKS.


Required Reading for Class: M. Davis and S. Masten. 2013. Principles of Environmental Engineering & Science. Chapters from this book will be posted on OAKS.

6 Tentative Class Schedule and Deadlines

<table>
<thead>
<tr>
<th>Dates</th>
<th>Lecture Topics</th>
<th>Event and Deadlines</th>
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</thead>
<tbody>
<tr>
<td>8/21-8/23</td>
<td>Introduction</td>
<td>9/6, Outline &amp; abstract due</td>
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<tr>
<td>8/26-8/30</td>
<td>Cr contamination</td>
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<tr>
<td>9/2-9/6</td>
<td>Chemical concepts</td>
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<td>9/9-9/13</td>
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<tr>
<td>9/16-9/20</td>
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<tr>
<td>9/23-9/27</td>
<td>Soils/ groundwater</td>
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<td>9/30-10/4</td>
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<tr>
<td>10/7-10/11</td>
<td>As contamination</td>
<td>10/11, Project proposal due</td>
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<tr>
<td>10/16-10/18</td>
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<td>10/14 - Fall Break</td>
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<tr>
<td>10/21-10/25</td>
<td>A Civil Action/ TCE contamination</td>
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<td>10/28-11/1</td>
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<tr>
<td>11/4-11/8</td>
<td>Climate change/Ocean acidification</td>
<td>Thanksgiving Week</td>
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<td>11/11-11/15</td>
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<td>11/18-11/22</td>
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<td>Final paper due</td>
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<td>11/25</td>
<td>Research presentations</td>
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<tr>
<td>12/2</td>
<td>Research presentations</td>
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7 Student Expectations

I expect all of you to have working knowledge of basic sciences (biology, physics, and/or chemistry) and basic math, including algebra. If you feel deficient, you will take the opportunity to brush up on some basics as required. Since you are in graduate school, I also expect that you have some experience in writing papers and making oral presentations in front of peer audiences. If your experiences are limited, then this is a course that requires you to polish up some skills. You are also expected to participate or lead a group projects or be able to work independently as required.
I don’t expect anyone to fail in this class, but, you need to put in some effort! Class attendance is most important part of this class and you may not do well if you miss classes. All deadlines will be strictly enforced, unless you have a very good excuse (death in family, contagious illness, etc., but being stressed out, etc. are not good excuses.)

8 Evaluation

You performance in this course will be assessed based on your understanding of basic environmental pollution concepts and the demonstration of your ability to apply this knowledge. This will involve a combination of (i) group problem-solving exercises – you will work in groups or by yourself, (ii) solo problem-solving exercises, (iii) paper and presentation associated with your research projects and case studies, and (iv) class participation.

1. Group problem-solving exercises will include solving problems and synthesis and interpretation of published data - there will be 6-7 of these – 20% of total grade. Notes: All students in the group get identical grade and hence it is important to work well together. Note that it is not necessary to work in a group, but, it is strongly encouraged. In some cases, I’ll pre-assign groups and all students within the group will have to work together. I’ll clearly specify if the exercise can be worked as a group assignment.

2. Solo problem-solving exercises include similar problems as above - there will be about 5-6 exercises total – 30% of total grade.

3. Brief, but in-depth, pollution case studies in areas that I do not plan to cover or of specific interest to you. This will be a small group (3-4 students) exercise. Each self-selected group identifies appropriate research papers ahead of time and shares these papers with entire class and then leads a discussion of 15-min each. Two of these exercises over the semester – 10% of total grade (entire group gets same grade.)

4. A 4000-word lab-research paper that is comprehensive and original in scope and takes a good look at specific aspect of a pollution related topic. You may work with another geology student on this project. Come and see me before you create an outline to discuss your topic. Use the journal “Environmental Pollution” as a model for your paper (see http://bit.ly/qyZNhg for instructions on preparing the project report in a manuscript form) – 30% of total grade.
Notes: Grade includes grades for all aspects of the paper, including the outline, the draft, and the final paper. Check course schedule for deadlines. I will provide detailed formatting and grading criteria over the next few weeks.

5. A 15 minute presentation of your project to the class during last week of class – 10% of total grade. Grading rubric will be provided over the last third of the semester.

6. Laboratory grade is separate from the lecture grade and will be based on lab reports (70%), lab journals (15%), and the quality of lab work (15%). Weekly projects are collaborative efforts, but each of you will synthesize and submit your own reports. Formatting instructions and grading criteria will be provided during first lab period.

The grade you earn by the end of the semester will be based on this scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>87-89</th>
<th>77-79</th>
<th>67-69</th>
<th>63-66</th>
<th>60-62</th>
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<tbody>
<tr>
<td>A</td>
<td>B+</td>
<td>C+</td>
<td>D+</td>
<td>D</td>
<td>F</td>
</tr>
<tr>
<td>A−</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>C−</td>
<td>&lt; 60</td>
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</tbody>
</table>

9 Course Product (or What you will get from this course)

On successful completion of this course, you will be able to

Vijay M. Vulava
Updated September 26, 2013
5 of 6
- Critically understand processes related to environmental contamination
- Interpret the behavior of naturally complex environmental systems
- Critically analyze environmental data and explain your findings and conclusions to your peers
- Integrate various basic sciences (chemistry, biology, geology, etc.) and mathematical skills to solve multidisciplinary problems
- Collaboratively develop research projects
- Develop other ancillary skills:
  - Become familiar with journals and technical sources in subject area
  - Become proficient in conducting literature reviews
  - Improve your presentation and science writing skills
  - Learn how to use software (Excel, \LaTeX, etc.) to analyze, visualize, and present chemical/physical data

10 CofC’s Honor Code and Academic Integrity

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines the student’s actions are clearly related more to a misunderstanding will handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed by both the instructor and the student will be forwarded to the Dean of Students and placed in the student’s file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student’s transcript for two years after which the student may petition for the X to be expunged. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration—working together without permission—is a form of cheating. Unless the instructor specifies that students can work together on an assignment and/or test, no collaboration is permitted. Other forms of cheating include possessing or using an unauthorized study aid (such as an iPhone or other smartphones), copying from others’ exams, fabricating data, and giving unauthorized assistance.

Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor.