

Environment and Natural Resources
Environmental Soil Chemistry and Remediation
ENR 5262
Autumn semester 2023

Meeting Dates and Location: Lecture WF 9:10 to 10:05, 245 Kottman Hall,
Lab F 10:20 to 12:20, 114 Kottman Hall

Course Format: In person

Instructor:

Dr. Nicholas T. Basta
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410 C Kottman Hall
2021 Coffey Rd

Course Coordinator:

Loryssa Lake
400 Kottman Hall, lake.195@buckeyemail.osu.edu

Credit Hours: 3

Credit hours and work expectations: This is a **3-credit-hour course**. According to [Ohio State policy](#), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

Prerequisites: One semester of chemistry

Textbooks/Readings:

None required, Course notes and materials provided on OSU Carmen Canvas.

Optional Readings:

Soil and Environmental Chemistry, 2nd ed. 2017. William F. Bleam. Academic Press, Cambridge, MA.
ISBN 978-0-12-804178-9

Additional Required Materials: None

Other Fees or Requirements: None

Course Description:

A comprehensive study of soil biogeochemical processes relevant to soil and chemical contaminant remediation. Emphasis is placed on soil and environmental chemical processes on human and ecological health, ecosystem function, and soil remediation. Water and soil solution chemistry; soil

carbon/organic matter, soil minerals, precipitation/dissolution, adsorption reactions and models, redox chemistry, soil acidity. Restoration / remediation topics include human and ecological contaminant exposure in soil-water systems; environmental fate of fertilizer, pesticides in agricultural soil; remediation of severely degraded coal mineland soils and water (acidity, other); remediation of salt degraded soil (i.e. surface impact from subsurface shale fracturing); remediation of contaminated (heavy metals, toxic organics) soil; restoration of urban soils. Socioeconomic considerations for environmental remediation methods, including cost and community / regulatory agency acceptance, will be studied. Laboratory component focuses in using hands-on soil investigation and remediation of contaminated sites. Use of advanced spectroscopic data and hand on experience using environmental soil chemistry computer models (e.g., USEPA geochemical speciation models).

Goals:

After completion of this course, students should:

1. Have a comprehensive understanding of biogeochemical processes in soil systems (i.e., soil, water, air, biotic) that impact environmental quality
2. Understand soil remediation sciences based on environmental chemistry, human and ecosystem function.
3. Be able to perform an environmental soil chemical investigation using laboratory data using the geochemical model Visual MINTEQ and evaluate remediation treatment success.

Learning Outcomes:

Course Learning Outcomes

1. Demonstrate an understanding of biogeochemical soil processes and environmental quality
2. Demonstrate an understanding environmental soil chemical risk based soil remediation
3. Demonstrate use of the geochemical model Visual Minteq to evaluate soil remediation

Successful students will have the demonstrated ability to

1. Recall and relate soil biogeochemical processes and soil remediation
2. Apply their knowledge to evaluate soil remediation plans
3. Demonstrate application of geochemical software to evaluate remediation plans

For help with your password, university e-mail, [Carmen](#), or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at [OCIO Help Hours](#), and support for urgent issues is available 24x7.

- **[Self-Service and Chat support:](http://ocio.osu.edu/selfservice)** (<http://ocio.osu.edu/selfservice>)
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Baseline technical skills for online courses

- Basic computer and web-browsing skills
- Navigating Carmen: for questions about specific functionality, see the [Canvas Student Guide](#).

Required software

- [Microsoft Office 365](#): All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through [Microsoft's Student Advantage program](#). Full instructions for downloading and installation is found <https://ocio.osu.edu/kb04733>.
- **Visual MINTEQ version 3.1**, <https://vminteq.lwr.kth.se/download/>

Carmen Access

You will need to use [BuckeyePass](#) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](#) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click "Enter a Passcode" and then click the "Text me new codes" button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the [Duo Mobile application](#) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and the IT support staff will work out a solution with you.

Course Schedule:

INSTRUCTIONAL WEEK	DATE	TOPICS, ASSIGNMENTS, DEADLINES, EVENTS, TOPIC OUTCOME
1	8/23 8/25	INTRODUCTION; SOIL AND WATER CHEMICAL ENVIRONMENT; SOIL REMEDIATION GOALS; REVEGETATION AND SOIL CHEMISTRY LAB 1
2	8/30-9/1	WATER AND SOLUTION CHEMISTRY LAB 2
3	9/6-8	MINERALS AND INORGANIC SOLID PHASES; SOIL ORGANIC C NO LAB
4	9/13-15	CHEMICAL PRECIPITATION REACTIONS LAB 3
5	9/20-22	SOIL CHEMICAL ADSORPTION REACTIONS LAB:REVIEW OF PROBLEM SET 1
6	9/27-29	CHEMISTRY OF N AND P IN SOILS EXAM 1
7	10/4-6	CHEMISTRY OF N AND P IN SOILS REMEDATION OF EXCESSIVE PHOSPHORUS SOILS LAB: REDOIX (LECTURE NOTES)
8	10/11-13	REDOX AUTUMN BREAK
9	10/18-20	REMEDATION OF SOIL ACIDITY AND ACID DEGRADED LAND LAB GREENHOUSE TREATMENT ACIDITY
10	10/25-27	PROBLEM SET 2 REVIEW EXAM 2
11	11/1-3	SOIL REMEDIATION AND EXPOSURE LAB 4 REMEDIATION OF COAL MINING DEGRADED LAND

12	11/8-10	SOIL REMEDIATION NO LAB – VETERANS DAY
13	11/15-17	SOIL REMEDIATION RISK BASED REMEDIATION LAB REMEDIATION OF ACID SOIL
14	11/22-24	THANKSGIVING BREAK
15	11/29, 12/1, 12/6	CASE STUDIES: REMEDIATION OF HEAVY METAL CONTAMINATED SOILS REMEDICATION OF URBAN SOILS’ LAB HEAVY METAL REMEDIATION PFAS AND THE FUTURE OF REMEDIATION
Final Exam	12/13	8:00 to 9:45

Instructor’s policy on late or make work:

Late work will have 10% of the total points deleted for each day it is late. This is based in the timestamp in Carmen, anything after the deadline is the next day and 10% off. Students should reach out to the instructor ASAP in the event of extenuating circumstances. Students will not be penalized for late assignments due to sickness or other approved extenuating circumstances

Evaluation:

How your grade is calculated

Undergraduate Students

ASSIGNMENT CATEGORY	% OF TOTAL POINTS
Examinations	55
Laboratory worksheets for 1st three labs @5 pts each	15
Laboratory Reports/projects, 2 @ 15 pts each	30
Total	100

Graduate Students

ASSIGNMENT CATEGORY	% OF TOTAL POINTS
Examinations	55
Laboratory worksheets for 1st three labs @ 5 pts each	15
Laboratory Reports/projects, 2 @ 15 pts each	30
Total	100

EVALUATION AND GRADING

Undergraduate Students

Examinations, exam 1 (15%), exam 2 (15%), exam 3 (25%), 55% total

Laboratory Short Reports (3 @ 5 pt each), 15% total

Laboratory reports/projects, (2 @ 15% each) 30% total

Graduate Students

Examinations, exam 1 (15%), exam 2 (15%), exam 3 (25%), 55% total

Laboratory Short Reports (3 @ 5 pt each), 15% total

Laboratory reports/projects, (2 @ 15% each) 30% total

Exams will be administered on Carmen and will be multiple choice and short answers. You must complete exams yourself, without any external help or communication. Either the instructor or the graduate assistant will be available for you to ask questions during the exam. Exams will have to be completed in a predetermined time interval.

Laboratory Short Reports

Completion of problem sets in laboratory worksheets will be required for the first five laboratory exercises. Example calculations to complete the worksheets will be given in the lab. Students will be required to complete the worksheet on their out of class time and turn it in for grading via carmen dropbox. Due dates for each worksheet will be announced in class. Anticipated due dates are one week after completion of the lab exercise.

Laboratory reports/projects

Laboratory activities during the semester will provide skills and knowledge to design two laboratory reports/projects on soil remediation: (i) remediation of soil acidity from agricultural and coal mining activities and (ii) remediation of heavy metal contaminated soils by in situ soil amendment. Students will analyze actual soil data from remediation projects to identify successful remedial practices. Laboratory reports will be written report including background information, remedial approach, remediation data (provided), data analysis, results/discussion and recommendations for remedial design.

Grading: standard OSU.

Grading Scale:

The standard grading scale is below. If deviating from the standard grade scale, the grade scale must be complete and span the total possible grades from A to E.

<u>Percentage</u>	<u>Grade</u>	<u>Percentage</u>	<u>Grade</u>
93-100	A	73-76.9	C
90-92.9	A-	70-72.9	C-
87-89.9	B+	67-69.9	D+
83-86.9	B	60-66.9	D
80-82.9	B-	<60	E
77-79.9	C+		

COURSE POLICIES

Faculty feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** For large weekly assignments, you can generally expect feedback within **7 days**.
- **E-mail:** I will reply to e-mails within **24 hours on school days**.

UNIVERSITY POLICIES see: <https://ugeducation.osu.edu/faculty-and-staff-resources> for current versions

Written assignments:

Your written assignments, including discussion posts, should be your own original work

Reusing past work:

In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.

Falsifying research or results:

All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.

Collaboration and informal peer-review:

The course includes many opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct at [Student Life](http://studentconduct.osu.edu) <http://studentconduct.osu.edu>.

Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an "excuse" for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- The Committee on Academic Misconduct web pages ([COAM Home](#))
- *Ten Suggestions for Preserving Academic Integrity* ([Ten Suggestions](#))
- *Eight Cardinal Rules of Academic Integrity* (www.northwestern.edu/uacc/8cards.htm)

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Intellectual Property (covered by copyright) includes Course materials (Text, Audio, Video, Multimedia, Sims, Apps, etc.), and Student Generated materials

Disability Services:

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Requesting accommodations

If you would like to request academic accommodations based on the impact of a disability qualified under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, contact your instructor privately as soon as possible to discuss your specific needs. Discussions are confidential. In addition to contacting the instructor, please contact the Student Life Disability Services at [614-292-3307](tel:614-292-3307) or ods@osu.edu to register for services and/or to coordinate any accommodations you might need in your courses at The Ohio State University.

Go to [Office of Student Life - Disability Services](#) for more information.

Diversity:

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

UNIVERSITY RESOURCES - see: <https://ugeducation.osu.edu/faculty-and-staff-resources> for current versions

Counseling and Consultation Services:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Title IX:

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu.