



**CIVE 658 – Remediation Systems - Subsurface Containment**

Semester: Fall 2016  
Credits: 3.0  
CRN: 77497  
Prerequisite: none<sup>1</sup>  
Lecture time: TR 3:30 – 4:45 pm  
Lecture location: Engineering B2  
Instructor: Joseph Scalia IV  
Instructor's office: A217 Engineering Hall  
Instructor's email: joseph.scalia@colostate.edu  
Office hours: WF 1:00 – 2:00 pm

**Course Description**

Graduate level course addressing the fundamental aspects of characterization and remediation of sites containing contaminated soil, sediment, and groundwater. Emphasis placed on the application of remediation and containment technologies.

**Course Objectives**

Familiarize students with concepts, terminology, and technologies used to address contaminated soil, sediment, and groundwater. Developing the skills needed for life-long learning.

**Learning Environment**

The primary emphasis of this course will be instructor lectures, classroom discussion, supplementary readings, homework, and guest speakers.

Required text: *none*.

Course website: [canvas.colostate.edu](http://canvas.colostate.edu). The Canvas website will be used to post homework assignments, additional instructional material, announcements, etc.

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<sup>1</sup> Some background in groundwater hydrology and contaminant transport will be useful, but this background will be covered in class to the extent needed based on the students' backgrounds. This approach is intended to allow students with variable backgrounds to take the course.

## Learning Assessment

Grading will be based on the following:

Homework	15%	
Exams	50%	(2 at 25%)
Project	25%	
Participation & professionalism	10%	
	<u>100%</u>	

Final grades will be based on the traditional grading scale, and **will not be curved**:

Grade	Percent range	Grade points
A <sup>+</sup>	≥ 96.7%	4.000
A	< 96.7%; ≥ 93.3%	4.000
A <sup>-</sup>	< 93.3%; ≥ 90.0%	3.667
B <sup>+</sup>	< 90.0%; ≥ 86.7%	3.334
B	< 86.7%; ≥ 83.3%	3.000
B <sup>-</sup>	< 83.3%; ≥ 80.0%	2.667
C <sup>+</sup>	< 80.0%; ≥ 76.7%	2.334
C	< 76.7%; ≥ 70.0%	2.000
D	< 70.0%; ≥ 60.0%	1.000
F	< 60.0%	0.000

*Homework* assignments will be given throughout the semester with defined due dates that will be strictly enforced. Grading will be based on a scale of 1 to 5, where 5 = excellent, 4 = very good, 3 = good, 2 = fair, and 1 = poor. A grade of zero will be given if homework is not turned in. All homework turned in for grading must be completed individually; however, students are welcome to discuss problems with a classmate or the professor.

*Two exams* will be given throughout the semester. Both exams will be closed book and closed notes. The exams will not be comprehensive. However, some basic principles carry over throughout the course, and therefore, must be mastered as part of the progression of learning.

*Make-up exams* will not be given, except in extraordinary situations and only if I have been notified well in advance of the exam date.

## Classroom and College Policy Information

*This course will adhere to the Colorado State University Academic Integrity Policy as found in the General Catalog<sup>2</sup> and the Student Conduct Code<sup>3</sup>. Academic misconduct undermines the educational experience at Colorado State University, lowers morale by engendering a skeptical attitude about the quality of education, and negatively affects the relationship between students and faculty. Any student found responsible for having engaged in academic misconduct will be subject to academic penalty and/or University disciplinary action. Examples of academic misconduct include: cheating, plagiarism, unauthorized possession or disposition of academic materials, falsification, and facilitation of any act of academic misconduct.*

<sup>2</sup> [catalog.colostate.edu/general-catalog/policies/students-responsibilities/](http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/)

<sup>3</sup> [conflictresolution.colostate.edu/conduct-code](http://conflictresolution.colostate.edu/conduct-code)

## Tentative Course Plan

Month	Date	Day	Topic <sup>1</sup>
Aug.	23	T	Remediation & containment: present, past, and future
	25	R	Regulations!
	30	T	Contaminant fate & transport overview
Sept.	1	R	Site characterization: site history, reconnaissance, invasive techniques, non-invasive techniques, conceptual models
	6	T	
	8	R	
	13	T	Remedial process (acronym soup)
	15	R	Geochemistry & surface reaction overview
	20	T	Passive remedial approaches: monitored natural attenuation, institutional controls
	22	R	Passive remedial approaches: containment-surface controls & caps
	27	T	Passive remedial approaches: containment-vertical cutoff walls
29	R		
Oct.	4	T	Exam I (in class)
	6	R	In situ treatment: solidification and stabilization
	11	T	
	13	R	
	18	T	In situ treatment: soil vapor extraction
	20	R	In situ treatment: pump & treat
	25	T	
	27	R	
Nov.	1	T	In situ treatment: permeable reactive barriers
	3	R	In situ treatment: oxidation & reduction
	8	T	
	10	R	
	15	T	Ex situ treatment: solidification, stabilization, vitrification
	17	R	Ex situ treatment: soil washing, incineration
	22	T	<i>No class – fall recess</i>
	24	R	
	29	T	
Dec.	1	R	Project presentations
	6	T	
	8	R	Group discussion: trade-offs of remediation
	12	M	Exam II (2:00 – 4:00 pm)

<sup>1</sup>Lecture topics and order are subject to change.

*Travel.* On occasion, my academic duties require that I must travel (e.g., attend conferences, meetings, present seminars, etc.). I will try to let you know as far in advance as possible. In all cases, we will make up any postponed classes, such that the full semester of lectures will be provided.