STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

CIVL 424 – Soil and Groundwater Remediation

CIP Code: 14.0805

Created by: Adrienne C. Rygel
Updated by:

School: Canino School of Technology
Department: Civil and Construction Technology
Implementation Semester/Year: Fall 2026

A. TITLE: Soil and Groundwater Remediation

B. COURSE NUMBER: CIVL 424

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

# Credit Hours per Week	**3**
# Lecture Hours per Week	**2**
# Lab Hours per Week	**2**
Other per Week	

D. WRITING INTENSIVE COURSE:

Yes	
No	x

E. GER CATEGORY:

Does course satisfy a GER category(ies)? If so, please select all that apply.

[1-2] Communication	
[3] Diversity: Equity, Inclusion & Social Justice	
[4] Mathematics & Quantitative Reasoning	
[5] Natural Science & Scientific Reasoning	
[6] Humanities	
[7] Social Sciences	
[8] Arts	
[9] US History & Civic Engagement	
[10] World History & Global Awareness	
[11] World Languages	

F. SEMESTER(S) OFFERED:

Fall	x
Spring	
Fall and Spring	

G. COURSE DESCRIPTION:

Students learn about the different types and characteristics of soil and groundwater contaminants. Theory and concepts of contaminant fate and transport are reviewed. Remedial methods and technologies for soil and groundwater contamination are examined. There is review and discussion of federal and state guidance, regulations, and other pertinent legislation that relates to site assessment and remediation.

H. PRE-REQUISITES: CIVL 323 Environmental Engineering or CIVL 322 Hydrology and Hydrogeology or CIVL 324 Water and Wastewater Treatment Design, or permission of the instructor

CO-REQUISITES:

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	Program Student Learning Outcome [PSLO]	GER	ISLO & Subsets
1. Access possible sources of contamination.	SO7		ISLO 5
2. Explain the structure and function of regulatory bodies, such as the US Environmental Protection Agency (EPA) and NYS Department of Environmental Conservation (DEC).	SO7		ISLO 5
3. Explain, discuss, and/or interpret environmental legislation that relates to soil, surface water, and groundwater contamination, assessment, evaluation, and evaluation.	SO7		ISLO 5
4. Discuss contaminant fate and transport of common environmental contaminants.	SO7		ISLO 5
5. Discuss, explain, and/or analyze the objectives, application, design, operation, and effectiveness of commonly used soil, surface water, groundwater, and air/vapor remedial systems.	SO7		ISLO 5
6. Design a remedial treatment system.	SO2		ISLO 5
7. Present and instruct the class on topics related to the course content in several assigned oral presentations. Prepare written fact sheets on each of the presentation topics for distribution to the class.	SO3		ISLO 1 (O+W)

KEY	Institutional Student Learning Outcomes [ISLO 1 – 5]

ISLO #	ISLO & Subsets
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA], Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit, /Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL],* *Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

J. APPLIED LEARNING COMPONENT:

Yes	x
No	

If yes, select [X] one or more of the following categories:

Classroom / Lab	x	Community Service	
Internship		Civic Engagement	
Clinical Practicum		Creative Works/Senior Project	
Practicum		Research	
Service Learning		Entrepreneurship [program, class, project]	

K. TEXTS:

None. Recommended references on EPA and DEC websites; and materials provided on Brightspace D2L by instructor.

L. REFERENCES:

- Bedient, Philip B., Riai, Hanadi S., and Newell, Charles J. (1997). Groundwater Contamination, Transport, and Remediation, 2nd edition. Upper Saddle River, New Jersey, Prentice Hall PTR.
- Hammer, Mark J. and Hammer Mark. J. Jr. (2008). Water and Wastewater Technology, 6th edition. Upper Saddle River, New Jersey: Pearson Prentice Hall.
- Knocke, William R., van Benschoten, John E., Kearney, Maureen (1990). Alternative Oxidants for the Removal of Soluble Iron and Manganese. Denver, Colorado: American Water Works Association Research Foundation and American Water Works Association.
- The Interstate Technology and Regulatory Council Perchlorate Team (2005). Perchlorate: Overview of Issues, Status, and Remedial Options, Technology Overview. Washington, D.C.: Interstate Technology and Regulatory Council.
- Interstate Technology and Regulatory Council In Situ Bioremediation Team (2002). A systematic Approach to In Situ Bioremediation in Groundwater, Technical/Regulatory Guidelines. Washington D.C.: Interstate Technology and Regulatory Council.
- Droste (1997). Theory and Practice of Water and Wastewater Treatment. New York, New York: John Wiley and Sons, Inc..

M. EQUIPMENT: None

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:
Exams
Homework Assignments
Presentations
Fact Sheets

P. DETAILED COURSE OUTLINE:

I. Introduction
II. Review of Hydrology, Hydrogeology, and Basic Water Quality
    A. River and Aquifer Systems
    B. Principles of Surface and Groundwater Flow
    C. Well Mechanics
    D. Water Quality Assessment Parameters
III. Sources and Types of Groundwater and Soil Contamination
    A. Underground Storage Tanks
    B. Dry Cleaners
    C. Landfills
    D. Septic Systems
    E. Agricultural Waste
    F. Industrial Waste
    G. Mining Operations
    H. Former US Defense Sites
IV. Site Assessment, Evaluation, and Remediation Regulations and Process
    A. Regulatory structure (US EPA, NYS DEC)
    B. Phase I ESAs (objectives, methods, requirements, procedures)
    C. Phase II ESAs (objectives, methods, requirements, procedures)
    D. Phase III ESAs (objectives, methods, requirements, procedures)
    E. CERCLA
    F. Updates, revisions, and changes to site assessment/remediation regulations
V. Contaminant Fate and Transport
    A. Advection, Absorption, Diffusion, and Dispersion
    B. Mass Transport Modeling
    C. Fate and Transport of common contaminants::
        i. Persistent organic pollutants (POPs)
        ii. Chromium IV
        iii. MTBE
        iv. 1,4-Dioxane
        v. Perchlorate
        vi. Mercury
        vii. DNAPLs
        viii. TCE
VI. Remedial Technologies and Approaches
    A. Natural Attenuation

B. Groundwater Extraction – Pump and Treat
C. In-Situ Chemical Remediation
D. Bioremediation
E. Institutional Controls
F. Soil Vapor Extraction
G. Flushing and Circulation Wells
H. Nanotechnology
I. Evapotranspiration Covers
J. Electrokinetcs
K. In-Situ Thermal Treatment
L. Phytotechnology
M. Solidification
N. Permeable Reactive Barriers

VII. Design of a Remedial System
A. Review technical literature on new/emerging remedial technology
B. Design a remedial system
C. Analyze and interpret results from a remedial system

Q. LABORATORY OUTLINE:

Conduct projects or give presentations on/related to the following topics:

1. Contaminant sources
2. Site assessment and the regulatory process
3. Contaminant fate and transport
4. Remedial technologies and approach
5. Analyze or design a remedial system