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

# MASTER SYLLABUS

## CONS 486 – Soil and Groundwater Remediation

**CIP Code: 15.0507**
***For assistance determining CIP Code, please refer to this webpage***
***https://nces.ed.gov/ipeds/cipcode/browse.aspx?y=55***
***or reach out to Sarah Todd at todds@canton.edu***

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**Canino School of Engineering Technology**
**DEPARTMENT of Civil and Construction Technology**
**Fall 2023**

A. TITLE: Soil and Groundwater Remediation

B. COURSE NUMBER: CONS 486

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

**# Credit Hours: 3**
**# Lecture Hours _2__ per Week**
**# Lab Hours _2 per__ Week**
**Other ___ per Week**

**Course Length (# of Weeks): 15**

D. WRITING INTENSIVE COURSE: No

E. GER CATEGORY:
Does course satisfy more than one GER category? No If so, which one?

F. SEMESTER(S) OFFERED: (*Fall*, *Spring*, *or Fall and Spring*) Fall

G. COURSE DESCRIPTION: Students learn about the different types and characteristics of soil and groundwater contaminants. 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.

H. PRE-REQUISITES: CONS 385 Hydrology & Hydrogeology or CONS 386 Water Quality or CONS 387 Water and Wastewater Treatment or permission from the instructor.
CO-REQUISITES:

I. STUDENT LEARNING OUTCOMES:

| ***Course Student Learning Outcome [SLO]*** | ***PSLO*** | ***GER*** | ***ISLO*** |
|---|---|---|---|
| a. Access possible sources of contamination | 1 | | 5 |
| b. Explain the structuring and function of regulatory bodies, such as the US Environmental Protection Agency (EPA) and NYS Department of Environmental Conservation (DEC) | 1 | | 5 |
| c. Explain, discuss, and/or interpret environmental legislation that relates to soil, surface water, and groundwater contamination, | 1 | | 5 |

| | | | |
|---|---|---|---|
| assessment, evaluation, and remediation. | | | |
| | | | |
| d. Discuss contaminant fate and transport of common environmental contaminants. | 1 | | 5 |
| e. Discuss, explain, and/or analyze the objectives, application, design, operation, and effectiveness of commonly used soil, surface water, groundwater, or air/vapor remedial systems. | 1 | | 5 |
| f. Design a remedial treatment system. | 2 | | 5 |
| g. Be able to communicate effectively and professionally technical content related to the course in verbal, graphical, and written forms; and an ability to identify and use appropriate technical literature. | 3 | | 1 (O,W) |

| KEY | **Institutional Student Learning Outcomes [ISLO 1 – 5]** |
|---|---|
| **ISLO #** | **ISLO & Subsets** |
| **1** | **Communication Skills**<br>Oral [O], Written [W] |
| **2** | **Critical Thinking**<br>*Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]* |
| **3** | **Foundational Skills**<br>*Information Management [IM], Quantitative Lit,/Reasoning [QTR]* |
| **4** | **Social Responsibility**<br>*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 one or more of the following categories:

Classroom/Lab__x_
Internship___
Clinical Practicum___
Practicum___
Service Learning___
Community Service___
Civic Engagement___
Creative Works/Senior Project___
Research___
Entrepreneurship___
(program, class, project)

K. TEXTS: Bedient, Philip B., Rifai, Hanadi S., and Newell, Charles J. (1997). Groundwater Contamination, Transport, and Remediation, 2nd edition. Upper Saddle River, New Jersey: Prentice Hall PTR.

L. REFERENCES:

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:

- oral presentations
- assignments
- exams

P. DETAILED COURSE OUTLINE:

**I. Introduction**
**II. Review of Hydrology and Hydrogeology**
**A. River and Aquifer Systems**
**B. Principles of Surface and Groundwater Flow**
**C. Well Mechanics**
**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: