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:

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<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>PSLO</th>
<th>GER</th>
<th>ISLO</th>
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<tr>
<td>a. Access possible sources of contamination</td>
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<td>b. Explain the structuring and function of regulatory bodies, such as the US Environmental Protection Agency (EPA) and NYS Department of Environmental Conservation (DEC)</td>
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<td>c. Explain, discuss, and/or interpret environmental legislation that relates to soil, surface water, and groundwater contamination.</td>
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d. Discuss contaminant fate and transport of common environmental contaminants.  

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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.  

|  | 5 |

f. Design a remedial treatment system.  

|  | 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.  

|  | 1 (O,W) |

### KEY

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| 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 |

### 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)

L.  REFERENCES:

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. Electrokinetes
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: