COURSE OUTLINE

CONS 486 – Soil and Groundwater Remediation

Prepared By: Adrienne C. Rygel, Ph.D.
CONS 486 – Soil and Groundwater Remediation

A. **TITLE:** Soil and Groundwater Remediation

B. **COURSE NUMBER:** CONS 486

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 Weeks

F. **SEMESTER(S) OFFERED:** Fall/Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   Lecture: 3 hours

H. **CATALOG 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.

I. **PRE-REQUISITES:**
   CONS 385 (Hydrology and Hydrogeology); and CHEM 150 (College Chemistry I and lab); and CONS 285 (Engineering Geology) or CONS 280 (Civil Engineering Materials) or CONS 216 (Soils in Construction); or permission from the instructor

J. **GOALS (STUDENT LEARNING OUTCOMES):**
   By the end of this course, the student will be able to:

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<th>Course Objective</th>
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   | a. Access possible sources of contamination | 1. Communication  
   | | 2. Critical Thinking  
   | | 3. Professional Competence |
   | b. Explain the structuring and function of regulatory bodies, such as the US Environmental Protection Agency (EPA) and NYS Department of Environmental Conservation (DEC) | 2. Critical Thinking  
   | | 3. Professional Competence |
   | c. Explain, discuss, and/or interpret environmental legislation that relates to soil, surface water, and groundwater contamination, assessment, evaluation, and remediation. | 1 Communication  
   | | 2. Critical Thinking  
   | | 3. Professional Competence |
   | d. Discuss contaminant fate and transport of common environmental contaminants. | 1. Communication  
   | | 2. Critical Thinking  
   | | 3. Professional Competence |
   | 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. Communication  
   | | 2. Critical Thinking  
   | | 3. Professional Competence |
   | f. Design a remedial treatment system. | 2. Critical Thinking  
   | | 3. Professional Competence |
g. Present and instruct the class on topics related to the course content in several assigned oral presentations.

1. Communication
2. Critical Thinking
3. Professional Competence
4. Inter/Intrapersonal Skills

K. TEXTS:

L. REFERENCES:


M. EQUIPMENT:
   None

N. GRADING METHOD:
   A-F

O. MEASUREMENT CRITERIA/METHODS:
   • Oral Presentations (each student will give 4 presentations throughout the semester, on each of the topics III, IV, V, and VI in the detailed course outline)
   • Assignments
   • Examinations

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. Electrokinetics
   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