

Course Form for PKU Summer School International 2019

Course Title	Remediation of Contaminated Environment
	污染环境修复
Teacher	LU Xiaoxia
First day of classes	July 1, 2019
Last day of classes	July 12, 2019
Course Credit	3 credits
Course Description	
Objective:	
Environmental pollution is a common problem all over the world, affecting the survival and development of human being. Remediation of contaminated environment (briefly, environmental remediation) refers to the removal of pollution or contaminants from environmental media such as soil, groundwater, sediment, and surface water. The objectives of this course are: (1) to introduce the basic theory, technology and practice of environmental remediation; (2) to discuss the investigation, risk assessment, remediation standard, and laws and regulations involved in environmental remediation.	
Pre-requisites /Target audience	
Students who are interested in environmental science or engineering.	
Proceeding of the Course	
The course will be delivered through lectures, video presentations, in-class discussions, and field trips. Students will be encouraged to participate in group projects and give presentations.	
Assignments (essay or other forms)	
One essay and one presentation.	
Evaluation Details	
Class participation: 25% Essay: 25% Presentation: 25% Final written report: 25%	
Text Books and Reading Materials	
Reading materials to be distributed in class.	

Academic Integrity (If necessary)	
Participation in this class commits the students and instructor to abide by a general norm of equal opportunity and academic integrity. It implies permission from students to submit their written work to services that check for plagiarism.	
CLASS SCHEDULE (Subject to adjustment)	
Session 1: <i>Introduction to Remediation of Contaminated Environment and overview of this course</i>	Date: July 1, 2019
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) An overall introduction to Remediation of Contaminated Environment to make the students familiar with the concept and the basic theory involved. Overview of the course, including the syllabus, assignment, field trip, and presentation schedule, is given.	
【Questions】 What is Remediation of Contaminated Environment? Why Remediation of Contaminated Environment is important? How Remediation of Contaminated Environment is developed? What is the basic theory involved in Remediation of Contaminated Environment? What are the levels of Environmental Remediation in China and other countries?	
【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class.	
【Assignments for this session (if any)】 Review of the lecture and online search for resources related to this lecture are encouraged.	
Session 2: <i>Investigation and risk assessment in Remediation of Contaminated Environment</i>	Date: July 2, 2019
【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the investigation and risk assessment methods in Remediation of Contaminated Environment. Illustrate how to determine the scope of remediation and the goal of remediation.	
【Questions】 How to investigate the contamination in environmental media and determine the scope of remediation? How to assess the risk in contaminated environment and determine the remediation goal? What are the target values for environmental remediation in China and other countries?	
【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class.	

<p>【Assignments for this session (if any)】 Review of the lecture and online search for resources related to this lecture are encouraged.</p>	
<p>Session 3: <i>Remediation of contaminated soil: physical and chemical methods</i></p>	<p>Date: July 3, 2019</p>
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the physical and chemical methods for remediation of contaminated soil, such as soil vapor extraction, thermal desorption, solidification/stabilization, etc. Case studies are analyzed.</p>	
<p>【Questions】 What is soil contamination and how it occurs? What are the principles for remediation of contaminated soil? What are the physical technologies for remediation of contaminated soil? What are the chemical technologies for remediation of contaminated soil? What are the advantages and disadvantages of physical and chemical methods? What are the application conditions for physical and chemical technologies?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class.</p>	
<p>【Assignments for this session (if any)】 Review of the lecture and online search for resources related to this lecture are encouraged.</p>	
<p>Session 4: <i>Remediation of contaminated soil: biological method</i></p>	<p>Date: July 4, 2019</p>
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the biological method for remediation of contaminated soil, including microbial remediation and phytoremediation. Related technologies such as land farming, biopile, composting, bioaugmentation, phytoextraction, rhizo-biodegradation, phytodegradation, etc. are illustrated.</p>	
<p>【Questions】 What is microbial remediation? What are the microbial remediation related technologies? What is phytoremediation? What are the phytoremediation related technologies? What are the advantages and disadvantages of microbial remediation and phytoremediation? What are the application conditions for microbial remediation and phytoremediation?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class.</p>	

<p>【Assignments for this session (if any)】 One group project on soil remediation is assigned.</p>	
<p>Session 5: <i>Remediation of contaminated ground water: physical and chemical methods</i></p>	<p>Date: July 5, 2019</p>
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the physical and chemical methods for ground water remediation, including pump and treat, air sparging, chemical oxidation, chemical reduction, etc. Case studies are analyzed.</p>	
<p>【Questions】 What is ground water contamination and how it occurs? What are the principles for remediation of contaminated ground water? What are the physical technologies for remediation of contaminated ground water? What are the chemical technologies for remediation of contaminated ground water? What are the advantages and disadvantages of physical and chemical methods? What are the application conditions for physical and chemical technologies?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class.</p>	
<p>【Assignments for this session (if any)】 Review of the lecture and online search for resources related to this lecture are encouraged.</p>	
<p>Session 6: <i>Remediation of contaminated ground water: biological method</i></p>	<p>Date: July 8, 2019</p>
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the biological method for remediation of ground water. Molecular technique for the detection and characterization of microorganisms in microbial remediation are illustrated. Students present group project result.</p>	
<p>【Questions】 What are the biological technologies for remediation of contaminated ground water? What materials are used to enhance the microbial remediation? How molecular techniques are applied to detect and characterize microorganisms in microbial remediation? What are the application conditions for biological technologies?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class.</p>	

<p>【Assignments for this session (if any)】 One group project on ground water remediation is assigned.</p>	
<p>Session 7: <i>Remediation of contaminated ground water: monitored natural attention</i></p>	<p>Date: July 9, 2019</p>
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the concept of monitored natural attention (MNA) and its application in ground water. Students present group project result.</p>	
<p>【Questions】 What is monitored natural attention? What are the application conditions for monitored natural attenuation? How to calculate the attenuation rate of contaminants in ground water?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed.</p>	
<p>【Assignments for this session (if any)】 Preview of the lecture and online search for resources related to this lecture are encouraged.</p>	
<p>Session 8: <i>Remediation of contaminated sediment: physical, chemical, and biological methods</i></p>	<p>Date: July 10, 2019</p>
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the physical, chemical, and biological methods for remediation of sediment, including monitored natural recovery (MNR) and enhanced MNR, in situ capping, in situ solidification/stabilization, environmental dredging, etc. Case studies are analyzed. Students present group project result.</p>	
<p>【Questions】 What is sediment contamination and how it occurs? What are the principles for remediation of contaminated sediment? What are the physical technologies for remediation of contaminated sediment? What are the chemical technologies for remediation of contaminated sediment? What are the biological technologies for remediation of contaminated sediment? What are the application conditions for various technologies?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class</p>	
<p>【Assignments for this session (if any)】 One group project on sediment remediation is assigned..</p>	

Session 9: <i>Remediation of contaminated surface water: physical, chemical, and biological methods</i>	Date: July 11, 2019
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the physical, chemical, and biological methods for remediation of surface water, including aeration, chemical precipitation, diatomite coagulation, biomanipulation, artificial floating island, etc. Case studies are analyzed. Student present group project result.</p>	
<p>【Questions】 What is surface water contamination and how it occurs? What are the principles for remediation of contaminated surface water? What are the physical technologies for remediation of contaminated surface water? What are the chemical technologies for remediation of contaminated surface water? What are the biological technologies for remediation of contaminated surface water? What are the application conditions for various technologies?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed, and selective video clips are played in class</p>	
<p>【Assignments for this session (if any)】 Preview of the lecture and online search for resources related to this lecture are encouraged.</p>	
Session 10: <i>Laws and regulations for Environmental Remediation</i>	Date: July 12, 2019
<p>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.) Introduce the laws and regulations for environmental remediation. Compare the laws and regulations in China with those in other countries. Review the whole content of this course.</p>	
<p>【Questions】 What are the laws and regulations for environmental remediation in China? How do the laws and regulations in China compare with those in other countries? What are the prospects for remediation of contaminated environment?</p>	
<p>【Readings, Websites or Video Clips】 Reading materials are distributed in class.</p>	
<p>【Assignments for this session (if any)】 Final written report on Remediation of Contaminated Environment is assigned.</p>	