Subject Description Form

Subject Code	CSE505
Subject Title	Contaminated Land and Sediment Remediation
Credit Value	3
Level	5
Pre-requisite / Co-requisite/ Exclusion	N/A
Objectives	This course is designed to develop students' abilities in assessing the environmental impacts of land contamination and applying adequate treatment technologies to restore contaminated soils, sediments, and groundwater. This course emphasizes both fundamental aspects and practical engineering applications of contaminated site remediation. We will focus on contaminant geochemistry, site investigation, and remedial technologies.
Intended Learning Outcomes	Through completing this course students will be able to: a. Describe contamination sources and relevant regulations; b. Perform site investigation and understand basic geochemistry; c. Evaluate and compare wide-ranging remediation technologies; d. Design cost-effective remediation strategies for real-world problems.
Subject Synopsis/ Indicative Syllabus	**1. Land Contamination and Contaminant Geochemistry (Week 1-3)** • Contamination sources and environmental regulations • Soil chemical properties and contaminant fate **2. Site Characterization (Week 4-5)** • Preliminary site assessment • Conceptual site model • Detailed site investigation **3. Remediation Technologies for Contaminated Soils, Sediments, and Groundwater (Week 6-13)** • Excavation/disposal and environmental dredging • Pump-and-treat and soil flushing/washing • Soil vapour extraction and air sparging • Bioremediation and monitored natural attenuation • Permeable reactive barriers and phytoremediation • Stabilization/solidification and chemical oxidation • Electrokinetics and thermal desorption
Teaching/Learning Methodology	**Teaching and Learning Approach** Lecture handouts will be provided at the beginning of each lecture and we will discuss the key ideas using the whiteboard or overhead projector. However, we expect you to take down the materials, as they are discussed, or illustrated with diagrams and graphs, for your personal study. We will use examples and problems to illustrate techniques and concepts but we expect that you will put in time outside lectures to refine your understanding through revision and additional reading and hone your problem solving skills by working through illustrative problems. We have no doubt that the understanding you gain in this course is directly related to the time you spend independently wrestling

with the concepts presented.

We are most strongly motivated to learn something that we clearly see the value and expect success in achieving it. Thus, there is no hidden agenda in our course. At the beginning of every lecture and learning activity, we will explain what the endpoints are and how we get there, so that you can put yourself into a position conducive to accomplishing these intended outcomes. To the end of encouraging a deep approach to learning, you will notice that we define the intended learning outcomes progressively from remembering level to applying, evaluating, and creating levels. Tools such as content maps that demonstrate links between various topics and subtopics will be utilized to help you to paint a holistic picture throughout the course.

We also aim to pay more attention to what learning activities you will take on in class. It is what you do in class or after class, rather than what we explain in lectures, that matters in your learning. Besides elaborating the engineering fundamentals in a deductive way, we will prepare learning activities that can enable you to achieve the intended learning outcomes.

Examples of in-class learning activities:

- video clips (experiment demonstrations, model simulations, case studies)
- hands-on exercises (true/false; multiple-choice; engineering calculations: you will be asked to convince your neighbor that your answers are the correct one)
- thought-provoking questions/take-home thoughts (more complex or open-end questions are given at the end of the week and discussion follows on next week)
- one-minute paper (open-ended questions related to the topic, issues that need further explanation, feedback on course/lecture)
- group discussion (given the engineering problems/scenarios, you will discuss in groups to work out the solutions, then present your ideas to other groups)

These in-class activities can: allow us to obtain information about how well you understand the material; and more importantly, provide you with feedback on your progress and highlight subject matter that you have not mastered. To this end you first have to participate actively in these activities.

Assessment

We see assessments as integral tools that encourage achieving the intended learning outcomes. We aim to use assessments to help you become reflective and self-directed learners, besides meeting our needs in providing evidence on your learning. The assessment for this paper will comprise two team projects and a final exam.

Team Projects

Objectives:

1. Review and present the new development for sustainable remediation (e.g., green remediation, risk-based community engagement, sustainable treatment technologies)
2. Design the remediation plan for the selected contaminated sites; explain and justify your remedial plan to the class

Teams will be formed by self-selection in week 1-2. Information of site investigation of selected contaminated sites will be provided. Each team will deliver a 20-min presentation in week 6 (sustainable remediation) and week 13 (remedial plan). The proposal and presentation will be assessed based on effective delivery of information, technical depth, and justification of selected remediation technologies.

It is important that you learn through reflecting on your own progress and evaluating peer's work. Halfway through the team projects, we will ask you to submit a reflective statement of your performance and provide constructive suggestions to team members, which will be distributed anonymously. This formative assessment will not be graded but aims to promote self-reflection and peer assessment.

At the end of the team projects you will contribute to ask questions about other teams' presentation. You will also assess your team member (summative peer assessment forms will be provided) so as to promote effective teamwork and adjust the individual grade from the team grade. More information will be elaborated in class.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a.	b.	c.	d.		
1. Continuous Assessment	50%	√	√	√	√		
2. Written Examination	50%		√	√	√		
Total	100%						

Written examination is evaluated by final examination.

Students must attain at least Grade D in both coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.

Reading List and References

Fetter, C.W. (1998). *Contaminant Hydrogeology, 2nd Ed*. Prentice Hall, Upper Saddle, NJ.

Reddi, L.N. and Inyang, H.I. (2000). *Geoenvironmental Engineering: Principles and Applications*. Marcel Dekker, New York.

Sharma, H.D. and Reddy, K.R. (2004). *Geoenvironmental Engineering: Site Remediation, Waste Containment and Emerging Waste Management Technologies*, John Wiley & Sons, New York.

Sparks, D.L. (2003). *Environmental Soil Chemistry, 2nd Ed.* Academic Press, Amsterdam.