CE 472W – ENVIRONMENTAL ENGINEERING CAPSTONE DESIGN
Fall 2010

Lecture: TR 9:45 – 11am, 140 Fenske

Instructor: **Prof. Rachel A. Brennan, Ph.D.**
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Office hours: T 1:00 – 2:30 pm; W 2:00 – 3:30 pm; or by appointment
You may also email questions directly to rbrennan@engr.psu.edu.

Textbook: None.

Texts on reserve at the Engineering Library (325 Hammond Building)**:**

Methods in Stream Ecology, 2nd Edition, 2007, F. R. Hauer and G. A. Lamberti, Academic Press, ISBN 10: 0-12-332908-6.

Volunteer Stream Monitoring: A Methods Manual, 1997, U. S. Environmental Protection Agency, EPA 841-B-97-003. *(provided on the course website: angel.psu.edu)*

Hazardous Waste Management, 1994, M. D. LaGrega, P. L. Buckingham, J. C. Evans, and Environmental Resource Management, McGraw-Hill Co., ISBN 0-07-118170-9.

Remediation engineering: design concepts, 1997, Suthan S. Suthersan, CRC Press, ISBN 1-56670-137-6.

CEE Program Outcomes mapped to this course:

- An ability to design a system, component, or process to meet desired needs
- An ability to function on multi-disciplinary teams
- An ability to communicate effectively
- An understanding of professional and ethical responsibility
- A knowledge of contemporary issues
- A recognition of the need for, and an ability to engage in, life-long learning

Specific course goals & objectives: 1) To design environmental remediation systems – for example, oxidation ponds, vertical flow wetlands, pump-and-treat, air stripping, soil vapor extraction, *in situ* bioremediation, monitored natural attenuation, reactive barriers, etc. – for two different contaminated sites; 2) to practice writing technical reports; 3) to practice giving formal presentations.

Grading:

Reading quizzes (10 points each x 2)	= 20 points	= 2 %
Site investigations (70 points each x 2)	= 140 points	= 14 %
Feasibility studies (70 points each x 2)	= 140 points	= 14 %
Project reports (200points each x 2)	= 400 points	= 40 %
Presentations (100 points each x 2)	= 200 points	= 20 %
Participation (5 points per week x 14)	= 70 points	= 7 %
Professional evaluation	= 30 points	= 3 %
Total	**= 1000 points**	**= 100%**

The standard grading system will be used to assign final letter grades in the course (A = 94 – 100%; A- = 90 – 93%; B+ = 87 – 89%; B = 84 – 86%; B- = 80 – 83%; C+ = 76 – 79%; C = 70 – 75%; D = 60 – 69%; F = 0 – 59%).

Lecture materials: Lectures will be provided to help students review the general material needed for completing the design requirements; however, it is expected that some students will need to research/review/gather additional information on their own, depending on their previous experience. Copies of the lecture materials (PowerPoint slides) will be provided in class, and will be posted on the course web page (angel.psu.edu).

Reading quizzes: One reading quiz will be given at the beginning of each design unit, based on a journal article or technical document provided in class the previous week. The ability to read technical information and apply it to your designs is an invaluable skill to have as a practicing engineer.

Site Investigations: The purpose of a Site Investigation is to compile and summarize as much information as possible about the site to enable your subsequent design. Your summary should include (but is not limited to): property ownership; site characteristics (ex., geology, hydrology, etc.); contamination history; contaminants of concern; contaminant characteristics & MCLs; risk assessment; delineation of soil and groundwater contamination plumes; site monitoring data; NPDES permits; and the remediation system(s) currently in use. Additional guidance/requirements on Site Investigations will be provided in class.

Feasibility Studies: The purpose of a Feasibility Study is to describe the remediation alternatives that are currently available to treat the contaminants of concern at the site. Then, based on the local site characteristics, develop a revised list of feasible treatment technologies. Your team will pick the best feasible technologies and provide a detailed technical explanation of how each one works, with consideration of the long- and short-term effectiveness, implementability, and relative cost. Your design plan for the site will develop from the Feasibility Study.

Project design reports & presentations: The goal of each of the projects is for you to design a remediation system to restore an actual contaminated site, based on the Site Investigation and Feasibility Study that you performed previously. It is recommended that you work on these projects in a team of 3 – 4 people of your choosing. Each team must make a formal oral presentation of their design to the class and submit a written report to me by the deadlines indicated in the syllabus. All reports must be typed and design drawings prepared in CAD, but detailed calculations may be completed neatly by hand on engineering paper and submitted in an Appendix (you must show your work to receive credit). Professional language style, grammar, punctuation, and neatness count (that's the "W" in CE472W – you MUST be able to write effectively). Projects will be graded on professionalism, creativity based on sound engineering principles, and technical accuracy. Late reports will be docked 20% of the total possible points for each 24 hour period (or fraction thereof) that they are late.

Participation & professional evaluation: All students are encouraged to participate actively in class discussions and field trips. You may also email questions/comments/feedback to me. *In any case, I want to know that you are alive and thinking critically about the material every week.* Several guest lectures/field trips by outside experts and practicing engineers have been scheduled throughout the semester: attendance at these activities is highly encouraged and will be reflected in your score under the participation category. Each week, 5 points can be earned for active participation (5 pts/wk x 14 weeks = 70 points), and my personal evaluation of your overall performance/professionalism/integrity throughout the semester is worth an additional 30 points.

Extra credit: Periodically throughout the semester there will be Environmentally-oriented seminars or activities around campus which I will announce during class or through Angel. For each of the activities that you attend, you can earn up to 5 points of extra credit if you write a 1-2 page summary of what you've learned (12 pt font, 1" margins, double spaced). **Write-ups are due within one week of the seminar.**

Academic honesty: Students are encouraged to work together on projects; however, **each student must significantly contribute in an original way to the work**. Confidential group evaluation forms will be required from each student on each assignment to ensure that grades are fairly assigned for the work performed. **Plagiarism** (i.e., copying the work/words of others without proper citation) on any graded activity will be penalized with a minimum of a zero points for the assignment, and up to a **failing grade** in the class. If you are not familiar with what constitutes an academic integrity violation, I encourage you to read Penn State's policies at: http://www.engr.psu.edu/CurrentStudents/acadinteg.asp.

Adherence to course schedule: Due to our collaboration with multiple outside speakers, I expect that we may deviate from the class schedule with respect to topics assigned to specific dates. However, I will notify you of any changes as soon as possible. The following page provides a tentative course schedule for the semester.

CE 472W – TENTATIVE COURSE SYLLABUS
Fall 2010

Dates	Lecture/Field Trip Topic	Reading* / *Guest Speaker*	Deliverables
Aug 24, T *Aug 26, R*	*No class* *No class*		**Questionnaire**
Aug 31, T	**L1**: Introduction, AMD overview		
Sept 2, R	**L2**: Water quality conditions & sampling	EPA Ch.5; Hauer Ch.5	
Sept 7, T	**L3**: Water chemistry calculations	PA Ch. 4	**Reading Quiz #1**
Sept 9, R	**L4**: **Field trip**: Klondike **(7–11am)**		
Sept 14, T	**L5**: AMD remediation design	handout	
Sept 16, R	**L6**: I-99 "acid rock" fiasco and treatment	*Dr. Barry Sheetz*	**AMD Site Investigation due**
Sept 21, T	**L7**: AMD remediation design (continued)		
Sept 23, R	**L8**: Active treatment, Anoxic LS Drains	*Dr. Jon Dietz*	**Feasibility Study & Design Plan due**
Sept 28, T	**L9**: Aeration: Fe-oxidation & cascades	handout	
Sept 30, R	**L10**: Permitting & cost estimation	AMDTreat	
Oct 5, T Oct 7, R	Design Q&A, work session Design Q&A, work session		
Oct 12, T Oct 14, R	Design team presentations Design team presentations		**Presentations!** **Presentations!**
Oct 19, T	**L11**: Groundwater remediation overview	LaGrega, Ch.2	**AMD remediation design report due!**
Oct 21, R	**L12**: Pump & treat, plume capture	Screening Matrix	
Oct 26, T	**L13**: Air stripping	Suthersan, Ch. 11	**Reading Quiz #2**
Oct 28, R	**L14**: Remediation case studies	*Arul Ayyaswami*	
Nov 2, T	**L15**: Soil vapor extraction (SVE)	Suthersan, Ch.3, 9	
Nov 4, R	**L16**: Bioremediation & natural attenuation	Suthersan, Ch.5	**GW Site Investigation due**
Nov 9, T	**L17**: Remediation case studies	*Rainer Domalski*	
Nov 11, R	**L18**: **Field trip**: Centre County Kepone Superfund Site **(9 – 11am)**		**Feasibility Study & Design Plan due**
Nov 16, T	**L19**: Permeable reactive barriers	Suthersan	
Nov 18, R	**L20**: Cost estimation		
Nov 23, T *Nov 25, R*	*No class (Thanksgiving break)* *No class (Thanksgiving break)*		
Nov 30, T Dec 2, R	Design Q&A, work session Design Q&A, work session		
Dec 7, T Dec 9, R	Design team presentations Design team presentations		**Presentations!** **Presentations!**
Dec 16, R	*Finals week*		**GW remediation design report due!**

***Reading assignments:** Reading assignments distributed with course notes must be read by everyone. Other readings in the course schedule are not required, and are intended to support the lectures if you are having difficulty understanding the material or need additional review.*