CE 110
Course Syllabus

Fall 2012
Part I Course Organization
CE 110
Introduction to
Environmental Engineering
Fall 2012

SYLLABUS

Goals: This course is intended to teach students the fundamental concepts in
environmental engineering dealing with water, air, and land pollution, and other areas
such as ecology, toxicology, global warming, ozone depletion, environmental
regulations, mineral resources, renewable and nonrenewable energy resources,
sustainable energy strategies, and pollution control technologies. Special focus will be
placed on sustainability throughout the semester. The course will also include the
following design components:

- design of small hydraulic systems for transport of water, and
- design of a small water treatment plant

Cooperative Learning: Strategy: During the class, we will be practicing important
concepts of skills of cooperative learning in small working groups of two to three
students. This strategy is designed to increase your mastery of the course content. You
will be expected to actively participate in an effort to ensure yours and your teammates' understanding of the ideas presented in the class. We need your commitment to
demonstrate a willingness to contribute ideas, to listen to others, and to be a
constructive force in the learning process.

Instructor: (Dr. P) - Professor Mike Pirbazari, Ph.D.
Office: KAP 260
Phone: 213-740-0592
E-mail: pirbazari@usc.edu
Class hours Lec. Mon. & Wed. 3:30 - 4:45pm; Dis. Mon. 5:00 - 5:50pm
Class location KAP 163
Office hours: Mon. 1:00 – 2:00pm @ 5:00 to 7:00pm; Tues. 4:00 – 7:00pm;
Wed. 1:00 to 2:30pm; also by appointment
Internet: www.usc.edu/dept/civil-eng/dept/ce110

Teaching Assistant: to be determined
Office: Phone:
E-mail: Office hours: to be determined

Grading Criteria:
Midterm Exam 15%
Final Exam 25%
Quizzes(4 @ 5 points each) 20%
Homework Assignments 15%
Term Project 15%
Class Participation 10%
Total 100%
Textbooks:

Reference (design text):

Students with Disabilities
Any student requesting academic accommodation based on disability is required to register with Disability Services and Programs Office (DSPO) each semester. A letter of verification for approved accommodations can be obtained from DSPO. Please be sure the letter is delivered to the instructor (or the TA) as early in semester as possible. DSPO is located in STU 301 and is open 8:30am – 5:00pm, Monday through Friday. The phone number for DSPO is (213) 740-0776. (This statement is suggested by the office of the Provost).

Academic Integrity
The use of unauthorized material, communication with fellow students during an examination, attempting to benefit from the work of another student, and similar behavior that defeats the intent of an examination or other class work is unacceptable to the University. It is often difficult to distinguish between a culpable act and inadvertent behavior resulting from the nervous tension accompanying examinations. When the professor determines that a violation has occurred, appropriate action, as determined by the instructor, will be taken.

Although working together is encouraged, all work claimed as yours must in fact be your own effort. Students who plagiarize the work of other students will receive zero points and possibly be referred to Student Judicial Affairs and Community Standards (SJACS).

All students should read, understand, and abide by the University Student Conduct Code listed in SCampus, and available at:
http://web-app.usc.edu/scampus/university-student-conduct-code/
### Schedules for Exams and Quizzes: Spring 2011

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Date</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quiz 1</strong></td>
<td>9/08</td>
<td>Chapters 1 &amp; 2; Unit 4</td>
</tr>
<tr>
<td><strong>Quiz 2</strong></td>
<td>9/29</td>
<td>Chapters 3, 7, and 11(part 1) and Unit 5</td>
</tr>
<tr>
<td><strong>Midterm</strong></td>
<td>10/25</td>
<td>Chapters 1,2,3,7,11, and design problems</td>
</tr>
<tr>
<td><strong>Quiz 3</strong></td>
<td>11/08</td>
<td>Chapters 12 &amp; 13 (part 1) and design problems</td>
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<tr>
<td><strong>Quiz 4</strong></td>
<td>11/22</td>
<td>Chapters 13 (part 2) and 15; Unit 10 and design problems</td>
</tr>
<tr>
<td>Term project presentation</td>
<td>11/29</td>
<td>Student Presentation</td>
</tr>
<tr>
<td>Term project presentation</td>
<td>12/01</td>
<td>Student Presentation</td>
</tr>
<tr>
<td><strong>Final exam</strong></td>
<td>12/13</td>
<td>Chapters 1,2,3,7,11,12,13 &amp;15; Units 4,5 &amp; 10 and design problems</td>
</tr>
</tbody>
</table>

(2:00 – 4:00 PM)
Topics Covered:

Course Description: Basic concepts of environmental engineering. Air, water, and soil pollution control technologies; pollution prevention strategies. Design of simple water distribution and treatment systems.

Environmental Problems, Their Causes and Sustainability (1/2 week)
- Living More Sustainably
- Population Growth, Economic Growth, Economic Development
- Environmental Problems: Causes and Connections
- Is Our Present Course Sustainable?

Science, Matter and Energy (1&1/2 weeks)
- Science, Technology, and Environmental Science
- Models and Behavior Systems
- Matter and Energy: Fundamental Concepts
- Law of Conservation of Matter
- Fundamental Laws of Energy
- Nuclear Changes
- Matter and Energy Change Laws and Sustainability
- Matter Cycling in Ecosystems (Biogeochemical Cycles)
  - The Water Cycle
  - The Carbon Cycle
  - The Nitrogen Cycle
  - The Phosphorus Cycle
  - The Sulfur Cycle

Climate and Biodiversity (1 week)
- Climate and Factors Affecting It
- Climate and Life on Land
- Aquatic Environments
  - Saltwater Life Zones (Estuaries, Coastal Wetlands, and Mangrove Swamps)
  - Freshwater Life Zones (Lakes, Streams, Freshwater Wetlands)

Geology and Nonrenewable Mineral Resources (1 week)
- The Nanotechnology Revolution
- Earth’s Major Geological Processes
- Harmful Effects of Using Mineral resources
- Mining and It’s Harmful Environmental Effects
- Sustainable Use of Mineral resources (Figure 12-14)
- Nanotechnology and sustainability
Energy (2 weeks)
- Evaluation Energy Resources
- Nonrenewable Fossil Fuels
  - Oil
  - Natural Gas
  - Oil Sand and Oil Shale
  - Coal
- Nonrenewable Nuclear Energy
- Improving Energy Efficiency
- Geothermal Energy
- Sustainable Energy Strategies

Air Pollution (1 week)
- Structure and Science of the Atmosphere
- Outdoor Air Pollution
- Photochemical and Industrial Smog
- Indoor Air Pollution
- Harmful Effects of Air Pollution
- Preventing and Reducing Air Pollution
- Air Pollution Control Technologies

Climate Change and Ozone Loss (1 week)
- Past Climate Change and the Natural Greenhouse Effect
- Climate Change and Human Activities
- Factors Affecting the Earth’s Temperature
- Dealing with the Threat of Global Warming
- Ozone Depletion in the Stratosphere
- Protecting the Ozone Layer

Hydraulics of Water and Wastewater Transport Systems (2 weeks)
- Pressure-Velocity-Head Relationships
- Flow in Pipes under Pressure
- Gravity Flow in Circular Pipes
- Storm Water Runoff Calculations

Water Resources and Water Pollution (2 weeks)
- Importance and Unique Properties of Water
- Supply, Renewal, and Use of Water Resources
- Problems Relating to Water Resources and Possible Solutions
- Pollution of Streams, Lakes, and Groundwater
- Marine Pollution
- Solutions to Water Pollution Problems
Drinking Water Treatment Plant Design (2 weeks)
- Understanding turbidity, natural organic matter (NOM), trihalomethanes (THMs), haloacetic acids (HAASs), and disinfection
- Chemical Coagulation and Flocculation Process:
  - Rapid-Mix Tank: determining size and shape
  - Flocculation Tank: determining size and shape
  - Sedimentation Tank: determining size and shape
  - Dual-media filter: determining size and shape
  - Chlorination Tank: determining size and shape

Solid and Hazardous Waste (1 week)
- Solid Waste in the United States
- Reuse
- Recycling
- Incinerating and Land Filling Solid Wastes
- Hazardous Waste Management
- Toxic Metals
- Achieving Low-Waste Society
CE 110
Term Project

Each student group (3 students in each group) will be required to present a term project, which will constitute 15% of the semester grade. A list of suggested topics is provided below. Students are required to submit a choice of topic by September 15th, 2010.

A 20 minute Powerpoint presentation on the term project topic is mandatory. Student presentations will be made in class on Nov. 29th and Dec. 1st, 2010. A sign up sheet will be passed around in class Nov. 22nd, 2010.

Suggested Topics

1. Ocean Energy: using the ocean’s tides, waves, and heat to generate electricity
2. Seawater desalination
3. Technologies for removing arsenic from water supplies in rural areas of Developing Countries
4. Using solar energy to provide heat and electricity for homes
5. Coral Reefs: formation mechanisms, causes of destruction, preventive strategies, restoration techniques
6. Ocean Pollution: sources of pollution, preventive measures, remedial strategies
7. Climate Change: sources of greenhouse gases, anthropogenic causes of global warming, factors affecting global warming, reducing the threats of global warming
8. Removing and Storing Carbon Dioxide (Carbon Sequestration): technology evaluations and economic considerations
9. Sustainable Cities: discussing and evaluating sustainable living programs in the United States
10. Using Wetlands to Clean Sewage and Storm Water
11. Using Bioenergy for Hybrid Vehicles
12. Using Nanotechnology for Groundwater Cleanup
Effective Class Participation

Please note the following suggestions for effective class participation:

1) Make every effort to interact with your class partner(s).

2) Try to stay active throughout the class period.

3) Don’t hesitate to ask questions in class.

4) Share your ideas with the rest of us.

5) Don’t hesitate to ask the instructor to repeat himself.

6) Keep an eye on your partner not to fall asleep in class!!

7) Try to bring new ideas to class.

8) Don’t read unrelated materials in class.

9) Share your ideas for class improvement with your instructor.

10) Put your fair share of efforts in preparing the term projects and the term paper. Be cooperative at all times.

11) Discuss your term paper and term project with the instructor periodically.

12) Come to class prepared.

13) Help your instructor make the class interesting.

14) Discuss your concerns and problems (if any) about the course with the instructor. He will do his best to accommodate your suggestions.

15) Late homework is not accepted.

16) Use of Lap tops in class is not permitted.

17) Tardiness is unacceptable.
Part II  Detailed Course Objectives
# Introduction to Environmental Engineering

**Course Information, Textbook, and Supplementary Materials**

**Course Description:** Basic concepts of environmental engineering. Air, water, and soil pollution control technologies; pollution prevention strategies. Design of simple water distribution and treatment systems.

**Required for:** BSCE Environmental; and BSENE degree programs

**Prerequisites and Co-requisites:** None

**Required Textbook:**

**Reference:**

<table>
<thead>
<tr>
<th>Topics Covered</th>
<th>Learning Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Environmental problems, their causes, and sustainability</td>
<td>Students will know and understand the following:</td>
</tr>
<tr>
<td></td>
<td>1. The root causes of environmental problems; principal types of pollution and how they can be reduced or prevented; natural resources (renewable, nonrenewable, and perpetual) and sustainability; and living more sustainably.</td>
</tr>
<tr>
<td>Science, matter and energy; ecosystem approach to sustaining biodiversity</td>
<td>2. The law of conservation of matter and types of energy; first and second laws of thermodynamics and their applications to the environment; matter recycling and reuse economies; and how to live more sustainably</td>
</tr>
<tr>
<td>Air pollution, global warming and ozone loss</td>
<td>3. Energy and matter in ecosystems; Biogeochemical cycles (carbon, water, nitrogen, phosphorus, and sulfur); Food chain, food web and diversity of organisms; and Effects of human activities on biomes (terrestrial and aquatic)</td>
</tr>
<tr>
<td>Air pollution, climate change, global warming, and ozone loss</td>
<td>4. Photochemical smog and air pollution; Harmful effects of air pollutants on humans, plants, buildings, etc.; Air pollution prevention and control strategies (particulate matter and gaseous pollutants), Global warming, its causes, and strategies to reduce it; and Ozone hole and strategies to prevent it.</td>
</tr>
<tr>
<td>Water resources and water pollution</td>
<td>5. World's freshwater supplies and associated problems; Water pollution problems in rivers, lakes, oceans and groundwater; Treatment of surface water containing turbidity; Treatment of domestic wastewater; and Prevention and reduction of water pollution.</td>
</tr>
<tr>
<td>Hydraulics of water and wastewater transport systems; Drinking water treatment plant [simple] design</td>
<td>6. Fundamental hydraulic design of pipes; Design of a pre-sedimentation tank; Design of rapid-mix tank for chemical addition; Design of flocculation tank; Design of sedimentation tank; and Design of chlorination tank.</td>
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</table>
# Lecture and Lab Schedule

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Lab</th>
</tr>
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<tbody>
<tr>
<td>Sessions per Week</td>
<td>Duration per Session</td>
</tr>
<tr>
<td>2</td>
<td>1.5 hours</td>
</tr>
</tbody>
</table>

# Contribution of Course to Meeting the Professional Component

**Engineering Topics | Other:**

**Constraints and Considerations.** Students will understand the diverse constraints and considerations that are representative of what they will encounter in an engineering practice. This course covers the following topics:

- Environmental
- Sustainability
- Health and Safety
- Energy

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## Relation of Course Objectives to Program Outcomes

The Civil Engineering program is designed to teach beyond the technical content of the curriculum and prepare the students to utilize what they learn in a professional setting.

This course contributes to the program outcomes as outlined in the adjacent table.

<table>
<thead>
<tr>
<th>Course Contribution to Program Outcomes (a-k)</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. An ability to apply knowledge of mathematics, science, and engineering.</td>
<td>✔️</td>
</tr>
<tr>
<td>c. An ability to design a system component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.</td>
<td>✔️</td>
</tr>
<tr>
<td>g. An ability to communicate effectively.</td>
<td>✔️</td>
</tr>
<tr>
<td>h. The broad education necessary to understand the impact of engineering solutions in a global economic and environmental and societal context.</td>
<td>✔️</td>
</tr>
<tr>
<td>i. Recognition of the need for, and an ability to engage in life-long learning.</td>
<td>✔️</td>
</tr>
<tr>
<td>j. Knowledge of contemporary issues.</td>
<td>✔️</td>
</tr>
</tbody>
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**Prepared by:** Dr. Mike Pirbazari  
**Professor of Environmental Engineering**

**Date:** Fall 2012