Instructor: Professor Mike Pirbazari (Dr. P)
Office: KAP260; Phone: (213)740-0592, Fax:(213)744-1426
E-mail: pirbazar@usc.edu

Office Hours: Monday: 1:00 to 2:30pm
            Tuesday: 4:00 to 7:00pm
            Friday: 2:00 to 5:00pm
            Also, by appointment

Class & Lab Hours: Lecture: Tuesday and Thursday 2:00-3:10pm; KAP 167

Laboratory Sessions:
Session 1: Monday 11:00 to 12:50pm
Session 2: Tuesday 11:00 to 12:50pm
Session 3: Wednesday 11:00 to 12:50pm

Lab Coordinator: Erick Hernandez
Office: BHE213K; Phone: (213) 740-6024
E-mail: hernandez@usc.edu

Course Content: Principles of environmental microbiology; water-borne pathogens;
                microorganisms and air pollution; microorganisms in soil; water pollution
                microbiology; biodegradation of hazardous chemicals. The course will include
                the following design topics: i) design of a small biological wastewater
                treatment plant, and ii) biological treatment design for sanitary landfill
                leachate.

Course Objective: The purpose of this introductory course is to provide the students the
fundamental principles of microbiology for environmental engineering
applications. The course includes laboratory work to offer them a good
experience in basic experimental techniques.

Suggested Prerequisite: CE 110 (Introduction to Environmental Engineering)

Grading Criteria: 2 Midterm Exam 20% (10% each)
                   Final Exam 15%
                   2 Quizzes 10% (5% each)
                   Homework 10%
                   Lab Reports 25%
                   Term Project 15%
                   Class Participation 5%

Schedules for Exams and Quizzes:
1st Quiz September 14
1st Midterm October 5
2nd Quiz October 28
2nd Midterm November 10
Final Dec. 9, 2:00-4:00 p.m.
Textbooks:


Pirbazari, M; "Class Notes for CE210L, Introduction to Environmental Engineering Microbiology" with Supplementary Reading Materials ; adapted by Prof. Pirbazari, 2010. *(Available on Blackboard)*

References:


**STATEMENT ON ACADEMIC INTEGRITY**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own.

All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: [http://www.usc.edu/dept/publications/SCAMPUS/gov/](http://www.usc.edu/dept/publications/SCAMPUS/gov/). Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: [http://www.usc.edu/student-affairs/SJACS/](http://www.usc.edu/student-affairs/SJACS/).

**STATEMENT FOR STUDENTS WITH DISABILITIES**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible.

**DSP Contact Information**

Office location: STU 301

Hours open: 8:30 a.m. until 5:00 p.m. — Monday through Friday.

Phone number: (213) 740-0776
Course Topics

1. **Ecological Principles (1 week)**
   - The Biosphere
   - The Community
   - Energy Transfer
   - Homeostasis
   - Ecosystem Management

2. **The Protists (1 week)**
   - Kingdoms in the Biological World
   - Procaryotes and Eucaryotes
   - Distribution of Microorganisms
   - Culture Techniques
   - Enumeration of Microorganisms
   - Light Microscopy and Electron Microscopy

3. **Procaryotes and Viruses (1 week)**
   - Bacteria
   - Actinomycetes
   - Blue-Green Algae
   - Viruses

4. **Eucaryotes (1 week)**
   - Fungi
   - Protozoa
   - Algae

5. **Microbial Nutrition and Growth (2 weeks)**
   - Nutrition
   - Heterotrophy and Autotrophy
   - Energy Transfer
   - Microbial Growth Kinetics
   - Growth Measurements
6. Death of Microorganisms (1 week)
   - Physical Destruction (temperature, sonication, uv irradiation, osmotic shock, etc.)
   - Chlorination Process and Chick’s Law
   - Heavy metals, Iodine, Ozone, and Permanganate as Disinfectants

7. Waterborne Pathogens (1 week)
   - Bacteria
   - Viruses
   - Protozoa
   - Schistosomiasis
   - Detection of Fecal Contamination
   - Detection of Viruses

8. Sanitary Sewer Pipe Design (1 week)
   - Gravity Flow in Circular Pipes
     - Manning Formula and Manning Nomograph
     - Gravity Flow in Partially-Full Sewer Pipes

9. Conventional and Advanced Wastewater Treatment (1 week)
   - Biochemical Oxygen Demand (BOD) and Suspended Solids
   - Activated Sludge Process
   - Biological Treatment for Nitrate Removal

10. Municipal Wastewater Treatment Design (2 weeks)
    - Role of Microorganisms in the Activated Sludge Process
    - BOD, Suspended Solids, and Discharge Standards
    - Flow Diagram and Schematics
    - Determining the size of the Grit Chamber
    - Determining the size and shape of the Primary and Secondary Clarifiers
    - Determining the Size of the Aeration Tank and Air Flow Requirements
    - Chlorination Tank Design
11. Biological Treatment Design for Landfill Leachate (2 weeks)
   - Leachate Characteristics and Discharge Guidelines
   - Leachate Collection System: piping layout, pumps, and holding tanks
   - Leachate Equalization Tank
   - Biological Aeration Tank (bacteria and powder activated carbon suspension)
     - * Reactor size and carbon usage
     - * Clarifier size and sludge re-circulation

12. Environmental Engineering Biotechnology (1 week)
   - In-Situ and Ex-Situ Bioremediation of Contaminated Soil and Groundwater
   - Vapor-Phase Biofiltration for Treatment of Industrial Emissions
   - Biodegradation/Adsorption Technology for Decontamination of Petroleum Hydrocarbons
   - Phytoremediation Technology for Decontamination of Environmental Pollutants
Term Project

Each student 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 16th, 2010.

A 20-minute Powerpoint presentation on the term project topic is mandatory. Student presentations will be made in class on Nov. 30th and Dec. 2nd and 4th, 2010. A sign up sheet will be passed around in class Nov. 23rd, 2010.

Suggested Topics

- Biofiltration Processes for Treating Industrial Gas Emissions
- Microorganisms and Energy Production
- In Situ and Ex Situ Bioremediation of Petroleum Hydrocarbons in Soil
- Bioventing and Bioremediation of Volatile Organic Compounds (VOCs) in Soil
- Biological Treatment of Leachate from Landfills
- Bioremediation of Petroleum Hydrocarbons in Marine Environment
- Ex-Situ Bioremediation of Volatile Organic Compounds (VOCs) in Groundwater
- Microbial Ecology of Activated Sludge Process
- Microbiologically-Induced Corrosion (MIC)
- Biological Treatment of Toxic Metals
- Microbial Ecology of Anaerobic Digestion Tank
- Role of Enzymes in Environmental Engineering Biotechnology
- Microbial Fuel Cell
- Phytoremediation of Soil and Groundwater
- In Situ Bioremediation of Groundwater
## Laboratory Schedule

<table>
<thead>
<tr>
<th>Session #</th>
<th>Week of:</th>
<th>Experiment #</th>
<th>Experimental Work</th>
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| 1         | Aug. 30  | 1            | I. Laboratory Safety Overview  
|           |          |              | II. Introduction to the Compound Microscope |
| 2         | Sept. 6  | 2            | The Plankton Community |
| 3         | Sept. 13 | 3            | The Bacteria |
| 4         | Sept. 20 | 4            | Water Quality Testing: The Coliform Test |
| 5         | Sept. 27 | 5            | Water Quality Testing: Membrane Filtration |
| 6         | Oct. 4   | 1st Midterm  |  |
| 7         | Oct. 11  | 6            | Activated Sludge and Hanging Drop |
| 8         | Oct. 18  |              | Field Trip |
| 9         | Oct. 25  | 7            | Enrichment Culture and Selective Techniques for Isolating Anaerobic Bacteria from Environment |
| 11        | Nov. 1   | 8            | Soil Microorganisms and Chemostat Studies |
| 12        | Nov. 8   | 2nd Midterm  |  |
| 13        | Nov. 15  | 9            | Electron Microscopy |
| 14        | Nov. 22  | 10           | Microorganisms and Energy Production |
| 15        | Nov. 30, and Dec. 2 | 10 | Paper Presentations |
| 16        | Dec. 9   |              | Final Exam — 2:00 to 4:00pm |
Laboratory Report Instructions

1. Your laboratory data reports should be taken/presented in 8” x 11” sheets stapled at the left-hand upper corner.

2. All data and experimental write-ups should be word-processed.

3. Laboratory reports will be collected at the beginning of the lab session for the experiment conducted on the previous session.

4. No late report will be accepted.

5. In your laboratory write-up, you must conform to the following format:

The first page of your laboratory report should contain:

CE 210L
INTRODUCTION TO ENVIRONMENTAL ENGINEERING MICROBIOLOGY
LABORATORY REPORT
EXPERIMENT #
Experiment title

GROUP #
YOUR NAME
DATE

Starting from the second page, the write-up must include the following sections:

PURPOSE:
DATA:
RESULTS & DISCUSSIONS:
SUMMARY:
QUESTIONS AND ANSWERS:
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 not acceptable**.