CE 210L Intro. to Environmental Eng. Microbiology 3 Units

USC | SONNY ASTANI DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

ABET Course Syllabus

Course Information, Textbook and Supplementary Materials

Course Description: 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.

Required for: BSCE-ENE and BSENE degree programs

Suggested Prerequisite: CE 110 (Introduction to Environmental Engineering)

Co-Requisite: None

Required Textbooks: Alcamo, I. Edward; *Microbiology,* Wiley Publishing, Inc. 1996

Pirbazari, M; "Class Notes for CE210L, Introduction to Environmental Engineering Microbiology" with Supplementary Reading Materials; adapted by Prof. Pirbazari, 2007 (available on the Blackboard)

Reference: Prescott, Lansing M.; Harley, Hohn P.; and Klein, Donald, A.; *Microbiology,* 6th Ed., W. C. Brown, Dubuque, Iowa, 2005.

Topics Covered	Learning Outcomes
Ecological Principles	Students will know the principles of environmental microbiology; microorganisms and air pollution; microorganisms in soil; water pollution microbiology; biodegradation of hazardous chemicals, as follows:
	1. The Biosphere, the Community, Energy Transfer, Homeostasis, and Ecosystem Management
Protists	2. Kingdoms in the Biological World, Procaryotes and Eucaryotes, Distribution of Microorganisms; Culture Techniques, Enumeration of Microorganisms, Light Microscopy, and Electron Microscopy
Procaryotes and Viruses	3. Bacteria, Actinomycetes, Blue-Green Algae, Viruses
Eucaryotes	4. Fungi, Protozoa, and Algae
Microbial Nutrition and Growth	5. Nutrition, Heterotrophy and Autotrophy, Energy Transfer, Microbial Growth Kinetics, and Growth Measurements
Death of Microorganisms	6. Physical Destruction (temperature, sonication, UV irradiation, osmotic shock, etc.) 7. Chlorination Process and Chick's Law 8. Heavy metals, Iodine, Ozone, and Permanganat as Disinfectants
Waterborne Pathogens	9. Bacteria, Viruses, Protozoa, Schistosomiasis, Detection of Fecal Contamination, and Detection of Viruses
Sanitary Sewer Pipe Design	10. Gravity Flow in Circular Pipes, Manning Formula and Manning Nomograph, and Gravity Flow in Partially-Full Sewer Pipes
Conventional and Advanced Wastewater Treatment	11. Biochemical Oxygen Demand (BOD) and Suspended Solids 12. Activated Sludge Process 13. Biological Treatment for Nitrate Removal

Municipal Wastewater Treatment Design	14. 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

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Topics Covered	Learning Outcomes
Biological Treatment Design for Landfill Leachate	15. 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; and 16. Clarifier size and sludge re-circulation
Environmental Engineering Biotechnology	17. 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; and Phytoremediation Technology for Decontamination of Environmental Pollutants

Lecture and Lab Schedule			
Lecture		**Lab**	
Sessions per Week	Duration per Session	Sessions per Week	Duration per Session
2	1.5 hours	1	3 hours

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.

	Course Contribution to Program Outcomes (a-k)	✓ Key
a.	An ability to apply knowledge of mathematics, science, and engineering.	
b.	An ability to design and conduct experiments, as well as to analyze and interpret data.	✓
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.	
g.	An ability to communicate effectively.	✓
j.	Knowledge of contemporary issues.	
k.	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	

Prepared by: Dr. Mike Pirbazari

Professor of Environmental Engineering

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