Civil and Environmental Engineering 114

Environmental Microbiology

3 units, Spring Semester, 2015
Lectures M-W-F 10:00-11:00
241 Cory Hall
Midterm tentative date: 3/11 in class
Final Exam Group 7, Tuesday 5/12, 3-6 pm

Professor: Lisa Alvarez-Cohen
726 Davis Hall
(510) 643-5969
e-mail: alvarez@ce.berkeley.edu
Office Hours: M 11:00-12:00, W 12:00-1:00

Teaching Assistant: Sara Gushgari
e-mail: gushgari@berkeley.edu
Office Hours: M/T 3:00-4:00 in 651 Davis

Course Website: bCourses.berkeley.edu

This course is an introduction to the general concepts of ENVIRONMENTAL MICROBIOLOGY for upper division undergraduates and graduate students who do not possess a strong background in microbiology. The course will emphasize the basic fundamentals of microbiology and microbial ecology described in the context of environmental engineering applications. Concepts relating to metabolic energy generation, physiology and kinetics will be emphasized, and real world applications associated with environmental engineering along with the pivotal role that microorganisms play in the existence of life on earth will be the central focus.

Approximate outline:

	Topic	**Assigned Reading (Brock)**
1	INTRODUCTION	Chap 1, Chap 2, bspace notes
	Background	
	The Cell	
	Microbial Characterization	
	Classification and Identification	
	Organic chemical background	
	Chemical Bonding	
	Structures and Nomenclature	
2	MICROBIAL CELL BIOLOGY	Chap 2, 3
	Prokaryotes	
	Bacteria	

	Archaea	
	Structure and Morphology	
	Cytoplasmic membrane	
	Cell wall	
	Other structures and inclusions	
	Motility	
3	ENERGY GENERATION AND BIOSYNTHESIS	
	Anabolism and Catabolism	
	Heterotrophs/Autotrophs	
	Non-photosynthetic	Energy Supp,
	Free Energy Change/ Reduction Potential	Redox Supp Appx 1
	Energy Conservation and Storage	CHAP 4.1, 4.4-4.10
	Electron Carriers, Electron Transport	
	Substrate level and Oxidative Phosphorylation	
	Short term, Long term	
	Quantification of Chemical Energy	4.11-4.12
	Fermentation	14.1-14.5
	Respiration	14.6.14.13
	Catabolic pathways	14.14-14.18
	Biosynthetic pathways	skim 4.14-4.16
	Metabolic Diversity	13.6-13.11
	Photosynthetic Energy Generation	13.0-13.5, Photosyn Supp,
4	METABOLIC STOICHIOMETRY AND GROWTH KINETICS	
	Stoichiometry for Cell Synthesis and Energy Generation	Stoichiometry Supp
	Microbial Growth, Detection, and Quantification	4.1-4.3, 5.0-5.7
	Cell Growth Cycles	Monod Supp
	Enzyme Kinetics	Enzyme Kinetics Supp
	Michealis-Menton	
	Cell Growth Kinetics: Monod	
	Chemostat Kinetics	5.8
	Primary/Secondary/Cometabolic substrates	Reactor Kinetics Supp
	Toxicity	
5	MICROBIAL GENETICS AND GENOMICS	Chap 6,
	Molecular Genetics	Genetics Supp
	DNA replication	
	Transcription and Translation	
	Protein Synthesis	
	Regulation	8.0-8.5
	Genetic Recombination	10.1-10.3, 10.6-10.9
	Genomics	12.0-12.3, 12.6
	Viruses	9.0 -9.10, Virus Supp
6	MICROBIAL ECOLOGY AND ENVIRONMENTAL SELECTION,	
	Ecosystems and Survival Mechanisms	Chap 5.9-5.18

Laboratory Culture of Cells	4.0-4.3
Enrichment and Isolation Methods	Chap. 22
Quantification of Microbial Activity	Microbial Methods Supp
Aquatic, Terrestrial, Marine Microbiology	Chap. 23
Nutrient Cycles	24.0-24.4, Nutrients Supp

Prerequisites: Chemistry 1A, B, or consent of instructor

Grading:	Homework	25%
	Midterm	30%
	Final	45%

Weekly Homeworks:

1. Homework will typically be distributed in class on Wednesday and will be due at the beginning of class the following Wednesday – either in hardcopy or uploaded to bCourses. **All** homework assignments must be turned in to pass this course. Late work will not be graded.
2. Regarding collaboration: To effectively learn the material in this class, careful understanding of the assigned reading and class lectures are required. The assignments are designed to ensure that you review and understand the relevant material. Therefore, you may discuss homework problems with the professor, teaching assistant, or other students, however, you may **not** examine the written work of other students (including those of a previous class). Exams will be closed book and notes and will emphasize (to the extent possible) comprehension over memorization, however the nature of the material necessitates extensive amounts of both.

Required Text:

Brock Biology of Microorganisms, M. T. Madigan, J. M. Martinko, D.A. Stahl and D. P. Clark. 2012. Benjamin Cummings, San Francisco CA, 13th Edition.

Additional Useful Texts:

Lehninger Principles of Biochemistry, D. L. Nelson, and M. M. Cox, 2008, W.H. Freeman and Co., New York.

Environmental Biotechnology: Principles and Applications, B. E. Rittmann and P. L. McCarty, 2001, McGraw-Hill Book Company, Boston Mass.

Wastewater Engineering: Treatment and Reuse, Metcalf and Eddy, 2004. McGraw-Hill Book Company, New York

Microbial Ecology, Fundamentals and Applications, R. M. Atlas and R. Bartha, Benjamin/Cummins Publishing Company, Third Edition. QR100.A87 1998