Environmental Biotechnology
Biological Engineering 431, Spring 2009
Course Syllabus

Instructor: P. Y. Yang
Office: Gilmore 105 Telephone: 956-8459
Office Hours: By appointment Email: pingyi@hawaii.edu

TA: N/A

Meeting Times and Locations
Monday, Wednesday, and Friday; 2:30 – 3:20 pm; Moore 120

Grading:	Homework:	20%
	Midterm Exam:	30%
	Final Exam:	30%
	Laboratory:	20%

Textbook: Environmental Biotechnology: Principles and Application (2001), B. E. Rittman and P. L. McCarty, McGraw Hill; ISBN# 0072345535

References: Wastewater Engineering: Treatment and Reuse (2003) Metcalf and Eddy, McGraw Hill

Handouts: Will be distributed in the class

Prerequisites: Consent

Catalog Description: 3 units. Environmental impact and control; the micro-organism and its nutrition and growth conditions; microbial growth and substrate removal kinetics; bioreactors; biological treatment system; biodegradation of xenobiotic organic chemicals; case studies.

Syllabus (Tentative):

Week	Lecture/Lab
1	Introduction/Wastewater Characteristics
2	Wastewater Characteristics - Total Solid/Suspended Solid - BOD (Biochemical Oxygen Demand) - COD (Chemical Oxygen Demand)
3	Microbial Growth Kinetics
4	Substrate Removal Kinetics
5	Biodegradability
6	Activated Sludge Process (Aerobic)
7	Lagoons (Aerobic)
8	Biofixed Film (aerobic) **Mid-Term Exam**
9	Laboratory (Solid/COD Analysis)
10	Laboratory (Biodegradability Study)
11	Spring Break
12	Anaerobic Treatment (Principle)
13	Anaerobic Treatment (Application)
14	Biological Nutrient Removal
15	Biological Detoxification of Hazardous chemicals
16	Applications/Case Studies, Review, **Final Exam**, and Student Evaluation

Important Dates:

January 12 – First day of class

January 19 – Martin Luther King Day (No class)

January 20 – Last day to drop classes and switch sections (without a 'W')

January 21 – (04:00 pm) Last day to add class

February 16 – President's Day (No class)

March 6 – Mid Term Exam (02:30 – 04:30 pm)

March 9 – March 20 – Laboratory

March 13 – (04:00 pm) Last day to withdraw from classes (with a 'W')

April 10 – Good Friday (No class)

April 3 – Turn in laboratory report

May 6 – Last day of class

May 11 – Final Exam (02:15 – 04:15 pm)

Course Policies:

1. Students with unexcused absences from labs will be marked absent, and not allowed to submit lab reports for them. Absences will only be excused for extreme circumstances such as serious injury or illness, death in the family, participation in varsity athletics or other university sponsored activities, or observation of religious holidays. A confirmatory note from the relevant authority will be required, and advanced notice should be given if possible.
2. While the labs will be completed in small teams, you are required to contribute the execution of the experiment, submit your own written reports, and be capable of performing all of the calculations and analysis required for the report.
3. The participation grade is largely determined by lab attendance and to a lesser extent by lecture attendance. Note, however, that the participation grade is awarded entirely at the

discretion of the instructor and will be severely impacted by habitual tardiness, disrespectful behavior towards your peers or other course participants, and lack of engagement/contribution in the experiments.

4. All pertinent work must be shown on exams and papers to receive credit. Unintelligible work will not be graded.
5. Questions are encouraged. The instructor should always make himself available to you during office hours.
6. Grading: if the overall class average is greater than 75%, those above 90% will receive an A, those above 80% will receive a B, those above 70% will receive a C, and those above 60% will receive a D. If the class average is less than 75%, the grades will be "curved" to make the average 75%, and letter grades will be assigned as described above. Note that the grade thresholds may arbitrarily be made lower than described above, but they will not be made higher (e.g., if you fall in a given range you may receive a grade higher than the nominal value of the range), though the instructor reserves the right to suspend the curving policy of the judges that students are generally not making a sincere effort to meet the course expectations.
7. Students are expected to be attentive in lab, and to learn from the execution of the coursework. To encourage this, a discretionary amount of extra credit will be awarded to students who identify errors in lectures or labs distributed by the instructor, or who offer simpler or more elegant proofs and derivations or analyses used in lab. Up to 3% may be added to the students final grade per incidence, depending on the severity of the error and/or the astuteness/analytical rigor of the student's observation/proof. All extra credit will be added after adjustment of the final averages so that other students' grades are not affected.

Course Learning Objectives

Upon completing this course, the student will be able to:	Level[†]	BE Outcome[‡]
i) understand basic principles of how light and electromagnetic radiation interact with materials;	M	b)
ii) understand reduction and oxidation processes, and their relationship to chemical energy;	M	b)
iii) understand the concept of pH, buffering, and protonation/ deprotonation;	M	b)
iv) recognize and define the problem to be solved;	M	d)
v) understand the role of environmental conditions on biological engineering;	M	d)
vi) have fundamental understanding of the material and chemical properties of biological materials;	M	d)
vii) engineer cost effective solutions to control or monitor a biological process	M	d)
viii) design a simple experiment, with effective controls, to quantitatively measure relevant parameters;	M	e)
ix) logically interpret data from experiments;	M	e)
x) share responsibilities and duties with team members;	D	g)
xi) objectively discuss the problem and the merits of possible solutions;	D	g)
xii) organize the content of a document according to the informational needs and technical background of audience;	D	i)
xiii) communicate facts supported by evidence and/or sufficiently detailed explanation;	D	i)
xiv) effectively assimilate feedback from a reviewer/ audience;	I	i)
xv) submit written work without errors in spelling, punctuation, and usage;	I	i)
xvi) understand the environmental impacts of biological engineering practice;	M	j)
xx) understand the role Biological Engineers face in addressing societal challenges.	M	l)

[†] I = Introductory; D = Developmental; M = Mastery.

[‡] UH Biological Engineering Program Outcomes:

a) The graduate has the ability to solve problems involving differential equations.

b) The graduate has the ability to solve physics problems involving mechanics, electromagnetics, and optics; chemistry problems involving inorganic and organic chemistry; problems involving general and micro-biology.

c) The graduate has the ability to solve engineering problems related to statics, dynamics, fluid mechanics, and thermodynamics.

d) The graduate has the ability to design a system, component, or process in which biology plays a significant role.

e) The graduate has the ability to design and conduct experiments to gather information for engineering designs.

f) The graduate has the ability to use modern engineering techniques, skills, and tools to define, formulate, and solve engineering problems.

g) The graduate has the ability to function effectively on multi-disciplinary teams.

h) *The graduate has the ability to identify professional and ethical responsibilities when practicing engineering*.

i) The graduate has the ability to communicate effectively in large and small groups.

j) The graduate has the background to understand the impact of engineering solutions on the surrounding context.

k) The graduate recognizes the need to engage in life-long learning through participation in professional conferences, workshops, and courses, and by reading and writing in the relevant literature.

l) The graduate has the ability to intelligently discuss contemporary issues.