University of Macau

Undergraduate Civil Engineering Programme

Coordinating Unit:	Department of Civil and Environmental Engineering, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	CIVL449	Year of Study:	4
Course Title:	Essentials to Environmental Biotechnology		
Compulsory/Elective:	Elective		
Course Prerequisites:	None		
Prerequisite Knowledge:	None		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture per week. (Laboratory works for the group projects, replacing the written final exam, throughout the semester)		
Laboratory/Software Usage:	None (Instrumentations available in Environmental Biotechnology Laboratory, WLG207)		
Course Description:	This course reflects the most current and exciting fields of environmental science engineering, as a combination of ET (Environmental Technology) and BT (Bio-Technology).		
Course Objectives:	1. To connect two different facets of environmental biotechnology, principles of environmental microbiology and environmental engineering. 2. To develop the basic concepts and quantitative tools in the principles part and then to apply those in the applications part.		
Learning Outcomes (LO):	Upon completion of this course, students should be able to: 1. Exploit microbiological processes to improve environmental quality, such as preventing the discharge of pollutants to the environment, cleaning up contaminated environment, and generating valuable resources for human society; 2. Have a solid background in environmental microbiology, provided with a foundation in taxonomy, metabolism, genetics, and microbial ecology; 3. Address the microbiology concepts that are most essential for understanding the principles and applications of environmental biotechnology.		
Texts & References: *(* recommended textbook(s))*	1. Rittmann, B.E. and McCarty, P.L. (2001)*, Environmental Biotechnology: Principles and Applications, McGraw-Hill. 2. Nazaroff, W.W. and Alvarez-Cohen, L. (2001), Environmental Engineering Science, John Wiley & Sons, Inc. 3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. (1985), Environmental Engineering, McGraw-Hill International. 4. Grady, Jr., C.P.L. and Lim, H.C. (1980), Biological Wastewater Treatment: Theory and Applications, Marcel Dekker, Inc.		
Student Assessment:	• Three tests (midterm and two homeworks): 55%; • One final examination (project presentation): 45%		
Learning Outcome Assessment:	• Tests and final examination. • Course evaluation		
Pedagogical Methods:	x Lecture ☐ Guest speakers ☐ Case study ☐ Role playing	☐ Service learning ☐ Internship ☐ Field study ☐ Company visits	

	x Student presentation	☐ e-learning
	x Project	☐ Independent study
	☐ Simulation game	Others:_ ___
	x Exercises and problems	

Major Assessment Methods: For each Major Assessment Method below, please indicate the specific pedagogical methods involved (by putting a ✓ in the relevant box(es) on the right-hand side).	Case Study	Role Playing	Student Presentation	Individual project/paper	Group project/paper	Simulation Game	Exercises & problems	Service learning	Internship	Field Study	Company visits	Written examination	Oral examination	Others (please specify)
Class Participation/ Discussion (0%)														
Assignment(s) (20%)							✓							
Test(s) (35%)												✓		
Examination (45%)			✓		✓									
Others *(please specify)* _____ (0 %)														
Course Web: (if any)	Course materials are available in UMMoodle (http://webcourse.umac.mo/).													

Course Content: (topic outline)

Week no.	Topics	Assignment no.	LO no.
1	**Course Overview: Introduction**	--	1
2	**Basics of Environmental Microbiology**	--	1,2
3	**Stoichiometry and Bacterial Energetics**	--	1,2
4	**Microbial Kinetics**	1	1,2
5	**Biofilm Kinetics**	--	1,2
6	**Reactors**	--	1,2
7	**Activated Sludge Process**	--	2,3
8	**Lagoons**	--	2,3
9	**Aerobic Biofilm Processes**	--	2,3
10	**Nitrification**	--	2,3
11	**Denitrification**	--	2,3
12	**Phosphorus Removal**	2	2,3
13	**Drinking Water Treatment/ Anaerobic Treatment by Methanogenesis**	--	2,3
14	**Detoxification of Hazardous Chemicals/ Bioremediation**	--	2,3

Percentage Content of:	Math	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total
	25	40	15	20	---	100
Timetabled work in hours per week:	Lecture	Tutorial	Laboratory	Other		Total
	3	---	(About 2-3 extra hours for the group project)	---		3

Contribution to Program Outcomes:

Program Outcomes	Contribution to POs[#] 5 ----------> 1 Significant Least				
	5	4	3	2	1
(a) apply knowledge of mathematics, science, and engineering	✓				
(b) design and conduct experiments, and analyze data			✓		
(c) design components, systems or processes in presence of constraints			✓		
(d) Function in a multi-disciplinary team		✓			
(e) Engineering problem solving	✓				
(f) Understand professional and ethical responsibility		✓			
(g) Communicate effectively		✓			
(h) Understand the impact of engineering solutions to the society		✓			
(i) Recognize the need and have the ability for lifelong learning		✓			
(j) Have knowledge of contemporary issues	✓				
(k) Apply the skills, techniques, modern engineering tools		✓			
(l) Use the computer/IT tools relevant to the discipline			✓		

 # Note 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support

Course Instructor(s):	Prof. Hojae Shim (Office, N324; Phone, 8397-4374; E-mail, hjshim@umac.mo)