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:	CIVL300	Year of Study:	3
Course Title:	Environmental Engineering I		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	Nil		
Prerequisite Knowledge:	College chemistry and college physics		
Duration:	One semester	Credit Units:	4
Class/Laboratory Schedule:	Three hours of lecture and two hours of tutorial per week.		
Laboratory/Software Usage:	The water quality laboratory analysis is adopted.		
Course Description:	This course is organized with the following chapters: introduction of environmental engineering; chemistry; materials and energy balances; ecosystems; risk perception, assessment and management; hydrology; water characteristics involving physical, chemical and biological aspects; water quality analysis including principles and methods involved in natural water quality process; physical and chemical modeling for water environmental processes involving chemical equilibrium, reaction kinetics, and reactor principles.		
Course Objectives:	1. To introduce to students the theory and application of analysis and assessment of environmental engineering process in ecosystems; 2. To develop students with an understanding of the chemical behavior of impacts of human activities onto the natural system; 3. To represent ecosystem, food web and nutrient cycles and material and energy balance in an ecosystem; 4. To state the process of risk assessment and risk analysis process especially concerned with potential carcinogens; 5. To apply the fundamental of hydrology, hydrology cycle and surface water and groundwater as a water supply; 6. To prepare students for the effective use of the conventional analytic methods for water quality analysis in laboratory.		
Learning Outcomes (LO):	Upon completion of this course, students should be able to: 1. understand the theory and application of environmental engineering in ecosystems; [POs: a, d, e, f, h, and j] 2. apply techniques of analytic chemistry to analyze water qualities of specific natural waters; [POs: a, b, d, e, and j] 3. recognize an ecosystem, food web and nutrient cycles and material and energy balance in an system; [POs: a, d, e, f and j] 4. realize the process of risk assessment and risk analysis process of human health which is effected by exposure of carcinogens; [POs: a, c, d, e, h, and j] 5. master the fundamental of hydrology, hydrology cycle and surface water and groundwater as a water supply; [POs: a, c, d, e, and j] 6. apply pilot study techniques for the effective use of the conventional analytic methods for water quality analysis in laboratory. [POs: a, b, and e]		

Texts & References: *(* recommended textbook(s))*	1. Mackenzie L. Davis, Susan J. Masten (2004), Principles of Environmental Engineering and Sciences, McGraw Hill Higher Education 2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous (1985), Environmental Engineering, McGraw-Hill 3. Clair N. Sawyer, Perry L. McCarty, Gene F. Parkin (fourth edition) (1991), Chemistry for Environmental Engineering, McGraw-Hill 4. Steel and McGhee (1990) Water Supply and Sewerage, McGraw-Hill
Student Assessment:	• Course work: 10%; • Laboratory: 15% • Mid-term test: 25%; • Final examination: 50%
Learning Outcome Assessment:	• Tests (including laboratory test) and final examination. • Course evaluation
Pedagogical Methods:	☑ Lecture ☐ Guest speakers ☐ Case study ☐ Role playing ☐ Student presentation ☐ Project ☐ Simulation game ☑ Exercises and problems ☐ Service learning ☐ Internship ☐ Field study ☑ Company visits ☐ e-learning ☐ Independent study ☑ Others: Chemical laboratory work

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) Chemical laboratory work
Class Participation/ Discussion (0%)														
Assignment(s) (10%)							✓							
Mid-Test (25%)												✓		
Examination (50%)												✓		
Others *(please specify)* Laboratory analysis tests (15 %)											✓			✓
Course Web: (if any)														

Course Content: (topic outline)

Week no.	Topics	Assignment no.	LO no.
1	**Introduction of natural water environments** Hydrological cycling of natural water; renewable natural resources; water pollutions and their impacts on the natural water processes in the receiving water bodies.	1	1
2,3	**Chemistry: concepts and principles** Inorganic chemistry; organic chemistry; water or aquatic chemistry; analytic chemistry; especially the carbonate buffering system is introduced to describe the natural water quality process.	2	2
4	**Water pH calculation with chemical equilibrium in natural waters** pH - master parameter in natural water quality processes; chemical equilibrium calculations.	R1	2,6
5,6	**Ecosystem and Mass and energy balances** Human influences on ecosystem; food web and nutrient cycles and population dynamics in ecosystem; Mass conservation principles; system dynamic analysis; energy conservation in natural water systems; essentials for chemical equilibrium and reaction kinetics.	3	3
7	**Water supply system** Field visiting to Macau water supply Co. Ltd. Get familiar with the water supply system of Macau, the potable water treatment process, operation, and its management	R2	1,2,6
8,9	**Risk perception, assessment, and management** Risk and hazard, knowledge of risk perception, the process of risk assessment, and risk management which focus on exposure of carcinogens	4	4
10,11,12	**Water qualities** Physical water quality parameters: color, order, temperature, turbidity and SS; chemical water quality parameters: alkalinity, biological and chemical water quality parameters: BOD, COD.	R3,4,5	2,6
13	**Ecological preservation** Field visiting to Macau Coloane-Taipa ecological preservation area; get familiar with the importance of wetland and the progress of Macau ecological preservation.	R6	3
14	**Hydrology** Introduction to hydrology; hydrographs; water conservation in nature; hydrographic analysis for rain fall events; surface runoff; infiltration; water resource engineering.	5	5

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. Wang Zhi Shi