CIVL3002 Environmental Engineering I
Syllabus

Coordinating Unit:	Department of Civil and Environmental Engineering, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	CIVL3002	Year of Study:	3
Course Title:	Environmental Engineering I		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	STGC1001 General Chemistry		
Prerequisite Knowledge:	College chemistry and college physics		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture and two hours of practice 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; biology; 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 environment systems; 2. To develop students with an understanding of the chemical behavior and 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. Deeply understand the great contribution of environmental engineering and environmental science in human's survival and development, and the importance of environmental engineering course [POs:a,e, f and h]; 2. Apply techniques of analytic chemistry to analyze water qualities of specific natural waters [POs: a,b and e]; 3. Understand general knowledge of biology and the theory and application of environmental engineering in ecosystems [POs: a, f and h] 4. Recognize the importance of material and energy balance in an system, master the relative calculative applications of mass balance [POs: a, and e]; 5. Realize the process of risk assessment and risk analysis process of human health which is effected by exposure of carcinogens [POs: a, and h];		

	6. Master the fundamental of hydrology, hydrology cycle and surface water and groundwater as a water supply [POs: a, and e]; 7. 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 (2014), Principles of Environmental Engineering and Sciences, 3rd Ed., McGraw Hill Higher Education 2. Stefan Franzle, Bernd Markert, Simone Wunschmann (2012), Introduction to Environmental Engineering, Wiley-VCH Verlag & Co. KGaA 3. Clair N. Sawyer, Perry L. McCarty, Gene F. Parkin (fifth edition) (2003), Chemistry for Environmental Engineering and Science, McGraw-Hill
Student Assessment:	• Course work: 20%; • Laboratory: 15% • Mid-term test: 25% • Final examination: 40%
Learning Outcome Assessment:	• Tests (including laboratory test) and final examination. • Course evaluation
Pedagogical Methods:	☑ Lecture ☐ Service learning ☐ Guest speakers ☐ Internship ☐ Case study ☐ Field study ☐ Role playing ☑ Company visits ☐ Student presentation ☐ e-learning ☐ Project ☐ Independent study ☐ Simulation game ☑ Others: Chemical laboratory work ☑ Exercises and problems

Major Assessment Methods:	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														
Assignment(s)							✓							
Mid-Test												✓		
Examination												✓		
Others *(please specify)* Laboratory analysis tests											✓			✓
Course Web : (if any)	Course materials are available in UMMoodle (https://ummoodle.umac.mo).													

Course Content:
(topic outline)

Week no.	Topics	Assignment no.	LO no.
1,2	**Introduction of Environmental Engineering** Definition and principles of environmental science and engineering; environmental systems overview; environmental legislation and regulation, environmental ethics	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
4,5	**Water pH calculation with chemical equilibrium in natural waters** pH – master parameter in natural water quality processes; chemical equilibrium calculations.	Lab R1	1,2,7
6,7	**Biology and Ecosystem** Chemical composition of life; energy and metabolism; diversity of living things; Human influence on ecosystem; food web and nutrient cycles and population dynamics in ecosystem; Field visiting to Macau Coloane-Taipa ecological preservation area; get familiar with the importance of wetland and the progress of Macau ecological preservation.	3,4	3
8	**Turbidity measurement with instrument setup** Laboratory practice with one of the important physical properties – turbidity measurement.	Lab R2	1,2,7
9	**Materials and energy balances** Mass conservation principles; system dynamic analysis; energy conservation in natural water systems; materials balances; energy balances; essentials for chemical equilibrium and reaction kinetics.	5	4
10,11	**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.	Lab R3,4	1,2,7
12,13	**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.	6	5
13,14	**Hydrology** Introduction to hydrology; hydrographs; water conservation in nature; hydrographic analysis for rain fall events; surface runoff; infiltration; water resource engineering.	7	6

Percentage Content of:	

Mathematics and Basic Sciences	Engineering Subjects	Complementary Studies	Total
10	90	0	100

Timetabled work in hours per week:	

Lecture	Tutorial	Practice	Total
3	---	2	5

Contribution to Programme Outcomes:

Programme Outcomes	Contribution to POs#	
	Primary	Secondary
(a) an ability to apply knowledge of mathematics, science, and engineering appropriate to the degree discipline	✓	
(b) an ability to design and conduct experiments, as well as to analyse 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		
(d) an ability to function on multi-disciplinary teams		
(e) an ability to identify, formulate and solve engineering problems		✓
(f) an ability to understand professional and ethical responsibility		✓
(g) an ability to communicate effectively		
(h) an ability to understand the impact of engineering solutions in a global and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public	✓	
(i) an ability to stay abreast of contemporary issues		
(j) an ability to recognise the need for, and to engage in life-long learning		
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline		
(l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations		

Course Instructor(s):	Prof. Li Yongjie (Please refer to the following link for the consultation hours of the course instructor: http://www.fst.umac.mo/cee/contacthour.html)