Environmental Engineering II (CIVL3003)

Syllabus

Coordinating Unit:	Department of Civil and Environmental Engineering, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	CIVL3003	Year of Study:	3
Course Title:	Environmental Engineering II		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	Environmental Engineering I (CIVL3002)		
Prerequisite Knowledge:	Water quality analysis and pollution impact assessment onto the natural waters		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture and two hours of laboratory practice per week		
Laboratory/Software Usage:	The water and wastewater treatment processes are demonstrated and the analyses of water and wastewater quality parameters are conducted.		
Course Description:	This course is organized with the following topics: water quality control in rivers; water and wastewater treatments: physical, chemical, and biological processes; design principles for water and wastewater treatment facilities; water treatment processes and unit operations including coagulation and flocculation, sedimentation and flotation, filtration and clarification; reactor principles and wastewater treatments including bio-chemical treatments, secondary sedimentation operation, activated sludge treatment process, bio-film treatment process.		
Course Objectives:	1. To introduce to students the design and operation of water and wastewater treatment processes; 2. To develop students with an understanding of the physical, chemical, and biological principles and applications of water and wastewater treatments; 3. To prepare students for the effective use of the conventional techniques and engineering analytical methods for design and operation of water and wastewater treatment engineering systems.		
Learning Outcomes (LO):	Upon completion of this course, students should be able to: 1. recognize the design philosophy of water and wastewater treatment processes; [POs: a, e, and k] 2. determine appropriate treatment parameters involved in drinking water treatment and municipal wastewater treatment processes such as yield coefficients, BOD decay constant, aeration rate constant, etc.; [POs: a, b, e, and k] 3. apply the principles, procedures, and current code requirements to the analysis and design of water and wastewater treatment engineering systems. [POs: a, b, e, i, and k] 4. apply pilot study techniques and laboratory analytical methods to analyze changes of water qualities of raw water and wastewater and to estimate efficiencies of the designed treatment engineering systems; [POs: a, b, e, and k]		

Texts & References: *(* recommended textbook(s))*	1. Nazaroff, W.W. and Alvarez-Cohen, L. (2001), Environmental Engineering Science, John Wiley & Sons, Inc.* 2. Davis, M.L. and Masten, S.J. (2004), Principles of Environmental Engineering and Sciences, McGraw Hill Higher Education. 3. Rittmann, B.E. and McCarty, P.L. (2001), Environmental Biotechnology: Principles and Applications, McGraw-Hill. 4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. (1985), Environmental Engineering, McGraw-Hill International. 5. Grady, Jr., C.P.L. and Lim, H.C. (1980), Biological Wastewater Treatment: Theory and Applications, Marcel Dekker, Inc.
Student Assessment:	• Course work: 10% • Laboratory: 15% • Mid-term test: 35% • Final examination: 40%
Learning Outcome Assessment:	• Tests (including laboratory exercise) 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: Laboratory practice

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)
Class Participation/ Discussion														
Assignment(s)							✓							
Midterm-examination												✓		
Final examination												✓		
Others *(please specify)* Laboratory practice_____											✓			✓
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.
1,2,3	**Water qualities in surface water** Physical water quality parameters: color, odor, temperature, turbidity, and SS; chemical water quality parameters: alkalinity, biological and chemical water quality parameters: BOD, COD, DO		1
4,5,6	**Introduction to water and wastewater treatments** Water quality management; physical treatment process; chemical treatment process; biological and chemical treatment process	1	2
7,8,9	**Design and operation principles for laboratory activity** Reaction principles; biochemical treatments: activated sludge treatment, bio-film treatment; zone sedimentation and design of circular clarification	Lab.	Report 1-4
10,11, 12	**Design and operation principles for water treatment** Unit operations; coagulation and flocculation; sedimentation and flotation; filtration and clarification; chemical softening; disinfection and chlorination	2	3
13,14	**Engineered systems for water and wastewater** Water treatment processes- theory and application; Engineered systems for primary treatment, primary sedimentation; Engineered systems for secondary treatment - activated sludge	--	4

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

<table>
<tr><td>Contribution to Programme Outcomes:</td><td>
<table>
<tr><th rowspan="2">Programme Outcomes</th><th colspan="2">Contribution to POs</th></tr>
<tr><th>Primary</th><th>Secondary</th></tr>
<tr><td>(a) An ability to apply knowledge of mathematics, science, and engineering appropriate to the degree discipline</td><td>✓</td><td></td></tr>
<tr><td>(b) An ability to design and conduct experiments, as well as to analyse and interpret data</td><td>✓</td><td></td></tr>
<tr><td>(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</td><td></td><td></td></tr>
<tr><td>(d) An ability to function on multi-disciplinary teams</td><td></td><td></td></tr>
<tr><td>(e) An ability to identify, formulate and solve engineering problems</td><td></td><td>✓</td></tr>
<tr><td>(f) An ability to understand professional and ethical responsibility</td><td></td><td></td></tr>
<tr><td>(g) An ability to communicate effectively</td><td></td><td></td></tr>
<tr><td>(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</td><td></td><td></td></tr>
<tr><td>(i) An ability to stay abreast of contemporary issues</td><td></td><td>✓</td></tr>
<tr><td>(j) An ability to recognise the need for, and to engage in life-long learning</td><td></td><td></td></tr>
<tr><td>(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline</td><td></td><td>✓</td></tr>
<tr><td>(l) An ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Course Instructor(s):</td><td>Prof. P. Zhang
(Please refer to the following link for the consultation hours of the course instructor: http://www.fst.umac.mo/cee/contacthour.html)</td></tr>
</table>