COURSE SPECIFICATION

Name of institution Mahidol University International College
Mahidol University

Campus/faculty/department Science Division

Section 1 General Information

1. Course code and course title

(Thai) **ICEN 421** การบำบัดน้ำและน้ำเสีย

(English) **ICEN 4**21 Water and Wastewater Treatment

2. Number of credits 4(4-0-8) (Lecture-Lab-Self-study hours/ week)

3. Curriculum and type of subject

3.1 Curriculum Bachelor of Science Program in Environment

3.2 Type of Subject Elective course

4. Faculty member responsible for the course and course lecturer

4.1 Course coordinator Dr. Chulaporn Kamnerdpetch

4.2 Course lecturers 1. Dr. Chulaporn Kamnerdpetch
2. Dr. Bundit Channarong

5. Trimester / year of study

5.1 Trimester 3th trimester/ Year of study 3rd or 4th year

5.2 Number of students 5-20 students

6. Pre-requisite None

7. Co-requisite None

8. Venue of study Mahidol University, Salaya campus

9. Date of latest revision July 2022

Section 2 Goals and Objectives

1. Goals

Students should be able to describe water utilization in different aspects; to describe water treatment technology, water quality inspection and the basic of water supply technology; to explain wastewater characteristic and general processes in wastewater treatment; to understand basic wastewater treatment methodology and wastewater reuse.

2. Objectives of development/revision

To update the knowledge content of the course

Section 3 Course Management

1. Course descriptions

(Thai) หลักการของเทคโนโลยีบำบัดน้ำ การเติมอากาศ การปรับพีเอชของน้ำ การสร้างและรวมตะกอน การตกตะกอนและการกรองน้ำ การแลกเปลี่ยนไอออนและการดูดซึม กระบวนการใช้เยื่อ และการฆ่าเชื้อโรค ความรู้พื้นฐานของน้ำประปา แหล่งน้ำดิบ ลักษณะเฉพาะ การตรวจสอบคุณภาพ เทคโนโลยีน้ำประปา แหล่งป้อนน้ำ ระบบจ่าย ปริมาณของน้ำ และการออกแบบความจุของน้ำประปา ลักษณะเฉพาะของน้ำเสีย การคาดคะเนปริมาณน้ำเสีย ระบบรวบรวมน้ำเสีย ระบบบำบัดน้ำเสีย การนำน้ำเสียกลับมาใช้ประโยชน์

(**English**) Principle of water treatment technology; aeration process, pH adjustment, coagulation and flocculation, sedimentation and filtration, ion exchange and adsorption, membrane process and disinfection; the basic of water supply; raw water source, characteristics, water quality inspection and water supply technology; source of supply, distribution system, quantity of water supply and design of water supply capacity; wastewater characteristics, wastewater forecasting, wastewater collecting system, wastewater treatment methods, wastewater reuse.

2. Credit hours / trimester

Lecture (Hour)	**Additional class (Hour)**	**Laboratory/field trip/internship (Hour)**	**Self study (Hour)**
44 (4 hours x 11 weeks)	-	-	88 (8 hours x 11 weeks)

3. Number of hours that the lecturer provides individual counseling and guidance

1 hour/week

Section 4 Development of Students' Learning Outcome

1. Course learning outcomes on students' knowledge, skills, behavior and other supplementary skills

1.1 Course learning outcomes

1. Possess knowledge related to theories and operation of water and wastewater treatment plants (CLO 1)
2. Retrieve relevant scientific information independently (CLO 2)
3. Independently complete in-class assignment (CLO 3)
4. Apply knowledge to synthesize solution and precautions for better practice in water and wastewater treatment plants (CLO 4)

1.2 Behavior and other supplementary skills that students will develop

1. To possess self-discipline and responsibility
2. To have the ability to evaluate ideas and evidence for problem solving

2. Teaching and evaluation methods using for evaluating knowledge, skills, behavior and other supplementary skills

Course Learning Outcomes on Knowledge, Skills and Behavior	Program Learning Outcomes	Teaching Methods	Evaluation Methods
Course learning outcomes (CLO)			
CLO 1	PLO 1, PLO 2, PLO 3 & PLO 4	Interactive online lecture and discussion	Attendance, assignments and examinations
CLO 2	PLO 2	Self-study	Attendance, assignments and examinations
CLO 3	PLO 2, PLO 3 & PLO 4	Interactive online lecture and discussion and self-study	On-time submission of assignments and their quality
CLO 4	PLO 1, PLO 3 & PLO 5	Interactive online lecture and discussion	Attendance, assignments and examinations
Behavior and other supplementary skills that students will develop			
1.To possess self-discipline and responsibility	PLO 1, PLO 2, PLO 3 & PLO 4	Interactive online lecture and discussion assignment	Class attendance and behavior in class, on-time submission of assignments
2.To have the ability to evaluate ideas and evidence for problem solving	PLO 1, PLO 3 & PLO 5	Interactive online lecture and discussion	Class participation, assignments and examinations

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Class	Topic/Activity	Number of Hours		Course Lecturer	Teaching Methods	Evaluation Methods	CLO
		Lect	Lab				
(1) 13/09/22 12.00-15.50	Water quality and usage, Preliminary treatment	4	-	Dr. Bundit Channarong	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(2) 20/09/22 12.00-15.50	Aeration, Coagulation	4	-	Dr. Bundit Channarong	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(3) 27/09/22 12.00-15.50	Flocculation, Sedimentation	4	-	Dr. Bundit Channarong	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(4) 04/10/22 12.00-15.50	Filtration, Disinfection, Clear well	4	-	Dr. Bundit Channarong	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(5) 11/10/22 12.00-15.50	Carbon adsorption, Membrane technology, Sludge treatment	4	-	Dr. Bundit Channarong	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
	Midterm Examination (to be announced)			**Dr. Bundit Channarong**			**1,4**
(6) 18/10/22 12.00-15.50	Wastewater characteristics: - Quantity and quality - Sources of wastewater - General processes in wastewater treatment	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4

Class	Topic/Activity	Number of Hours		Course Lecturer	Teaching Methods	Evaluation Methods	CLO
		Lect	Lab				
(7) 25/10/22 12.00-15.50	Physical wastewater treatment methods	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(8) 01/11/22 12.00-15.50	Chemical wastewater treatment methods	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Assignment 3. Examination	1,2,3,4
(9) 08/11/22 12.00-15.50	Biological wastewater treatment methods I: Aerobic processes	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(10) 15/11/22 12.00-15.50	Biological wastewater treatment methods II: Activated Sludge	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture & Discussion 3. Self-study	1. Class participation 2. Assignment 3. Examination	1,2,3,4
(11) 22/11/22 12.00-15.50	Biological wastewater treatment methods III: Anaerobic processes	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Examination	1,2,4
(12) 29/11/22 12.00-15.50	Sludge treatment and disposal	4	-	Dr.Chulaporn Kamnerdpetch	1. Interactive lecture 2. Discussion 3. Self-study	1. Class participation 2. Assignment 3. Examination	1,2,3,4
(13) 06/12/22	**Final Examination**	**4**	**-**	**Dr.Chulaporn Kamnerdpetch**			**1,4**
Total				**Lecture 48 hours Self-study 96 hours**			

2. Evaluation plan

Evaluation Methods		Expected Learning Outcomes		Class	Percentage
Class attendance		-	-	1-12	5
Class assignments	Discussion	CLO 1	PLO 1, PLO 2	1-5, 6-12	5
	Term paper report	CLO 2, CLO 3	PLO 2, PLO 3, PLO 4	2-3, 5, 7	6
Examination	Midterm	CLO 1, CLO 4	PLO 1, PLO 2, PLO5	6	35
	Final			13	49
				Total	**100**

Section 6 Teaching Materials and Resources

1. Texts and main documents

1. Basile A, Cassano A, and Rastogi NK. Advances in Membrane Technologies for Water Treatment [electronic resource]: Materials, Processes and Applications. Cambridge: Woodhead, 2015.
2. Chittaranjan R, and Ravi J. Drinking Water Treatment: Focusing on Appropriate Technology and Sustainability. Dordrecht; New York: Springer, 2011.
3. Drinan JE and Spellman FR. Water and Wastewater Treatment: A Guide for the Nonengineering Professional. Boca Raton, Fla: CRC Press/Taylor & Francis, 2013.
4. Droste RL and Gehr R. Theory and Practice of Water and Wastewater Treatment Hoboken, NJ.: John Wiley & Sons, 2019.
5. Hopcroft FJ. Wastewater Treatment Concepts and Practices. New York: Momentum Press, 2015.
6. Leslie Grady CP, Daigger GT, Love NG, and Filipe CDM. Biological wastewater treatment. Boca Raton, FL: CRC Press, IWA, 2011.
7. Spellman FR. Handbook of Water and Wastewater Treatment Plant Operations. Boca Raton: CRC Press/Taylor & Francis, 2009.

2. Documents and important information

Hand-outs

3. Documents and recommended information

Additional readings suggested by the instructors

Section 7 Evaluation and Improvement of Course Management

1. Strategies for effective course evaluation by students

1.1 Evaluation of peers by students

1.2 Student evaluation

(1) Course content

(2) Course management

(3) Suggestions

(4) Overall opinion

2. Evaluation strategies in teaching methods

2.1 Student evaluation

2.2 Presentation

3. Improvement of teaching methods

Workshop on course improvement with the participation of all instructors in the course

4. Verification of students' learning outcomes

Analysis of students' learning outcomes using scores from class attendance, assignments, presentation of reports and examinations.

5. Review and improvement for better outcome

Regular communication between lecturers and supervisor to review the course before term starts and throughout term as needed.

Signature C. Kamnerdpetch Digitally signed by chulaporn.kam Date: 2022.07.27 14:34:18 +07'00'

(Dr. Chulaporn Kamnerdpetch)

Faculty member responsible for the course

Appendix

Alignment between courses and general education courses

Table 1 Thee relationship between CLOs and Program Los (Number in Table = Sub LOs)

ICEN312	Learning outcomes in Environmental Program					
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1: Possess knowledge related to theories and operation of water and wastewater treatment plants	1.1	2.1				
CLO2: Retrieve relevant scientific information independently		2.2 **2.3**				
CLO3: Independently complete in-class assignment		2.2 **2.3**	3.2	4.1		
CLO4: Apply knowledge to synthesize solution and precautions for better practice in water and wastewater treatment plants	1.2				5.1	

Table 2 The description of Program LOs and Sub LOs of the course

Program Learning Outcomes (PLOs)	Sub PLOs
1. Critical Thinking: demonstrate critical thinking skills in relation to environment sciences	1.1 Possess basic knowledge of water and wastewater treatment technology. 1.2 Apply knowledge of water and wastewater treatment technology. 1.3 Possess technical skills in the water and wastewater treatment technology. 1.4 Apply technical skills in water and wastewater treatment technology.
2. Communication: demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of contexts	2.1 Comprehend qualitative, quantitative data and/ or ideas 2.2 Draw meaningful conclusion from the learning materials 2.3 Retrieve relevant scientific information independently 2.4 Manage scientific literatures using reference management program
3. Interdisciplinary Synthesis: demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns	3.1 Demonstrate proficiency in practical of water and wastewater treatment technology. 3.2 Demonstrate proficiency in written communication of water and wastewater treatment technology.
4. Ecological Literacy: demonstrate an awareness, knowledge and appreciation of the intrinsic values of ecological processes and communities.	4.1 Independently complete in-class assignment 4.2 Apply concept of lab safety and field study safety 4.3 Able to set, plan and accomplish assigned project in a timely manner
5. Sustainability: create alterative solutions to environmental issues focusing on sustainability through research projects interdisciplinary.	5.1 Identify environmental issues on sustainability relevant to given situations 5.2 Design interdisciplinary research project to solve the identified problem 5.3 Strengthening of international cooperation and supporting the establishment of networks

Program Learning Outcomes (PLOs)	Sub PLOs
6. Innovation Initiative: demonstrate an ability understanding a problem and delivering solutions consistently, deliberately and methodically.	6.1 Formulate a process for data acquisition 6.2 Demonstrate systematic and logical thinking 6.3 Understand the potential for knowledge transfer towards innovation 6.4 Develop a propensity for lifelong learning and skills to achieve it