



Course Syllabus (Academic Year 2020)

School of Interdisciplinary Studies, Kanchanaburi Campus, Mahidol University

1. **Course No. and Title** : KAED 313 BIOLOGICAL UNIT PROCESSES
Credit (study hours) : 3(3-0-6)
2. **Program Name** : Bachelor of Engineering in Environmental and Disaster Management
3. **Course Module** : Major Required Courses
4. **Pre/co-requisite** : KAED 207 BIOLOGICAL OF ENVIRONMENTAL ENGINEERING
 KAED 312 Environmental Unit Operations
5. **Class Semester** : 1st Semester 2nd Semester Academic Year 2020
6. **Class Schedule & Venue** : Thursday 13:00 – 16:00, Room XXX, Lecture Building
7. **Class Coordinator** : Dr. Wimonmas Boonyungyuen
 Contact No. : 08-1906-6678 Email : wimonmas.booo@mahidol.edu

8. Course Description

Fundamentals of biological unit processes in wastewater treatment, fundamental of reactor engineering kinetics of biochemical system, modeling of ideal biochemical reactors, applications of the biological operations including attached and suspended growth systems: F/M ratio, SRT, SVI aerobic and anaerobic processes in combined and separated operations.

9. Course Objectives / Course Learning Outcomes (CLOs)

No.	Objectives / CLOs	Expected Skills / Knowledge			PLOs	ABET
		Specific	Generic	Knowledge		
8.1	Understand principle of biological process and apply biological process to wastewater treatment	SS1+SS2	GS1+GS3+GS4 +GS7+GS8+GS12	K1+K2+K3+K5+ K10+K11+K12+ K25+K26	1, 4	a, c, d, e, f, g, l, j
8.2	Understand principle of biochemical kinetics and mathematics model for ideal bio-chemical reactor	SS1+SS2	GS1+GS3+GS4 +GS6+GS7+GS8 +GS9+GS10+GS11 +GS12	K1+K2+K3+K5+ K10+K11+K12+ K25+K26	1, 4	a, c, d, e, f, g, l, j

10. Class Instructor List

10.1 Name : Dr. Wimonmas Boonyunguen Contact No. : 08 1906 6678

Email : wimonmas.booo@mahidol.edu

11. Course Outline

Week	Date	Contents	CLOs	Instructor's Names
1	21/01/21	- Introduction to Course outline and Measurement - Introduction of biological process - Principle of biological treatment process	8.1, 8.,2	Dr. Wimonmas
2	28/01/21	- Type of microorganism in biological treatment process and mechanism of microorganism growth - Factor of efficiency for microorganism in wastewater treatment process	8.1, 8.,2	Dr. Wimonmas
3	4/02/21	- Criteria for considering quality and quantity of wastewater for wastewater treatment	8.1, 8.,2	Dr. Wimonmas
4	11/02/21	Principle of mass balance in wastewater treatment system - Batch Reactor - Completed Mix (no return)	8.1, 8.,2	Dr. Wimonmas
5	18/02/21	Principle of mass balance in wastewater treatment system (Cont.) - Completed Mix (return) - Plug-Flow Reactor	8.1, 8.,2	Dr. Wimonmas
6	24/02/21 (15.00-18.00 น. ซดเซยวัน มาชฌูชา)	Principle of mass balance in wastewater treatment system (Cont.) - Sequence Reactor - Fixed-Film Reactor	8.1, 8.,2	Dr. Wimonmas
7	4/03/21	Mathematics model for ideal bio-chemical reactor	8.1, 8.,2	Dr. Wimonmas
8	11/03/21	Mathematics model for ideal bio-chemical reactor (Cont.)	8.1, 8.,2	Dr. Wimonmas
9	Mid-term Examination (15-19/03/21)			
10	25/03/21	- Biological wastewater treatment and type of biological wastewater treatment - Criteria for design biological wastewater	8.1, 8.,2	Dr. Wimonmas

		treatment and parameter for design		
11	1/04/21	Principle of Aeration Treatment and Design	8.1, 8.,2	Dr. Wimonmas
12	8/04/21	Principle of Aeration Treatment and Design (Cont.)	8.1, 8.,2	Dr. Wimonmas
13	21/04/21 (15.00-18.00 น. ชดเชยวัน สงกรานต์)	Principle of Anaeration Treatment and Design	8.1, 8.,2	Dr. Wimonmas
14	22/04/21	Principle of Natural Treatment and Design	8.1, 8.,2	Dr. Wimonmas
15	29/04/21	Improvement of water quality and wastewater treatment by biology	8.1, 8.,2	Dr. Wimonmas
16	6/05/21	Field Trip and Presentation	8.1, 8.,2	Dr. Wimonmas
17	Final Examination (13-25/05/21)			

12. Course Assessment

No.	Methods / Activities	Regulations	CLOs	Week	Weight Distribution (%)
11.1	Mid-term exam	<input checked="" type="checkbox"/> Content (Week 1-8) <input checked="" type="checkbox"/> Closed book <input checked="" type="checkbox"/> Faculty-approved calculator <input checked="" type="checkbox"/> 3 Hours	8.1, 8.,2	9	35
11.2	Final exam	<input checked="" type="checkbox"/> Content (Week 10-16) <input checked="" type="checkbox"/> Closed book <input checked="" type="checkbox"/> Faculty-approved calculator <input checked="" type="checkbox"/> 3 Hours	8.1, 8.,2	17	35
11.3	Quiz / Activities	<p>Each 30-min quiz will be given in class and cover the content from the previous weeks.</p> <p>There will be no make-up quizzes.</p>	8.1, 8.,2	2,4,6,7,12	15
11.4	Reports / Assignments	Each student will receive assignments or Homework by	8.1, 8.,2	1,5,6,8,11,16	10

		the given deadline. You will have one week to finish each set of Homework.			
11.5	Class participation	Student must attend class more than 80% of course.	8.1, 8.,2	1-8 and 10-16	5
				Total	100

13. Grading System

Criterion-referenced evaluation

Grade	Score	Grade	Score	Grade	Score	Grade	Score
A	≥ 80 %	B	70 – 74.99%	C	60 – 64.99%	D	50 – 54.99%
B+	75 – 79.99%	C+	65 – 69.99%	D+	55 – 59.99%	F	< 50 %

Norm-referenced evaluation

*If use both criterion and norm-referenced evaluation, please tick two boxes.

14. References

13.1 McCabe WL. Smith JC. and Harriott P. Unit Operation for Chemical Engineering. McGraw-Hill ;New York. 1993.

13.2 Reynolds and Richards. Unit Operations and Processes in Environmental Engineering. 2nd edition. PWS Publishing Company.

13.3 กรมโรงงานอุตสาหกรรม, ๒๕๔๘, ตำราระบบบำบัดมลพิษน้ำ, พิมพ์ครั้งที่ ๒, กรุงเทพมหานคร : สำนักเทคโนโลยีสิ่งแวดล้อมโรงงาน.

13.4 เกียรติศักดิ์ อุดมสินโรจน์. การบำบัดน้ำเสีย. กรุงเทพมหานคร : มิตรนราการพิมพ์. ๒๕๓๙

13.5 เกียรติศักดิ์ อุดมสินโรจน์. วิศวกรรมกรรมการกำจัดน้ำเสีย เล่มที่ ๑. กรุงเทพมหานคร : มิตรนราการพิมพ์. ๒๕๓๕.

13.6 เกียรติศักดิ์ อุดมสินโรจน์. วิศวกรรมกรรมการกำจัดน้ำเสีย เล่มที่ ๒. กรุงเทพมหานคร : มิตรนราการพิมพ์. ๒๕๓๕.

13.7 เกียรติศักดิ์ อุดมสินโรจน์. วิศวกรรมกรรมการกำจัดน้ำเสีย เล่มที่ ๓. กรุงเทพมหานคร : มิตรนราการพิมพ์. ๒๕๓๕

Note:

Specific Skill (SS)	
SS1	Assess Quantity & Quality of Wastewater
SS2	Specify Important Criteria for Suitable and Reliable* Wastewater Treatment *based on regulations, economics, and disaster awareness
Generic Skill (GS)	

GS1	Systematic Thinking, Problem Solving and Analytical Skills
GS2	Basic Computer Skills
GS3	Environmental and Disaster Risk Awareness
GS4	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
GS5	A knowledge of contemporary issues
GS6	an ability to communicate effectively
GS7	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
GS8	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
GS9	a knowledge of contemporary issues
GS10	a recognition of the need for, and an ability to engage in life-long learning
GS11	Creativity and Carefulness
GS12	Interpersonal and Coordinating Skills
GS13	Flexibility and Adaptability
GS14	Basic Listening, Speaking, Reading, and Writing Skills in English
GS15	Formal and Informal Communication
GS16	Leadership and Decision Making
Knowledge (K)	
K1	Wastewater Quality
K2	Probability and statistics
K3	Wastewater Demand/Supply
K5	Material and Energy balances
K10	Wastewater Characteristics
K11	Environmental Unit Operation for Wastewater Treatment
K12	Standards of Effluents
K25	Laboratory experiments
K26	Basic microbiology
PLOs	
PLO1	Design, Operate, and Control Water Supply and Pollutant Treatment Systems According with Criteria of Council of Engineers and Concepts of Disaster Risk Management (Adaptation)
PLO2	Apply Suitable Information Technology (IT) for Environmental System Design, Environmental Impact Assessment, and Disaster Risk Prediction.
PLO3	Use both Formal/Informal and Verbal/Non-verbal Thai and English to Effectively Communicate in Technical Contexts.
PLO4	Apply Professional Ethics and Responsibilities under Up-to-date Regulations and Agreements Related to Environment and Disaster Issues
ABET	

(a)	an ability to apply knowledge of mathematics, science, and engineering
(b)	an ability to design and conduct experiments, as well as to analyze and interpret data
(c)	an ability to design a system, component, or process to meet desired needs within and safety, manufacturability, and sustainability realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d)	an ability to function on multidisciplinary teams
(e)	an ability to identify, formulate, and solve engineering problems
(f)	an understanding of professional and ethical responsibility
(g)	an ability to communicate effectively
(h)	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i)	a recognition of the need for, and an ability to engage in life-long learning
(j)	a knowledge of contemporary issues
(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.