



Course Syllabus (Academic Year 2019)

School of Interdisciplinary Studies, Kanchanaburi Campus, Mahidol University

1. **Course No. and Title** : KAED 422 WASTEWATER ENGINEERING AND DESIGN
Credit (study hours) : 3(3-0-6)
2. **Program Name** : Bachelor of Engineering in Environmental and Disaster Management
3. **Course Module** : Major Required Courses
Pre/co-requisite : KAED 312 Environmental Unit Operations
 KAED 313 Biological Unit
4. **Class Semester** : 1st Semester 2nd Semester Academic Year 2019
5. **Class Schedule & Venue** : Wednesday 09:00 – 12:00, Room XXXX, Lecture Building
6. **Class Coordinator** : Dr. Wimonmas Boonyungyuen
 Contact No. : 08-1906-6678 Email : wimonmas.booo@mahidol.edu

7. Course Description

Wastewater characteristics, wastewater flow rates, design of wastewater collection systems, combined and separated sewers, pump and pumping stations, wastewater treatment and effluent standards, design of facilities for physical, chemical and biological wastewater treatment, disinfection, sludge treatment and disposal.

8. Course Objectives / Course Learning Outcomes (CLOs)

| No. | Objectives / CLOs | Expected Skills / Knowledge | | | PLOs | ABET |
|-----|---|-----------------------------|--|---|------|------------------------------|
| | | Specific | Generic | Knowledge | | |
| 8.1 | Understand the key concepts, components and design criteria for wastewater treatment design. | 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 | Apply the knowledge techniques, and skills for analyzing and solving the defined wastewater engineering problems. | 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 |

9. Class Instructor List

9.1 Name : Dr. Wimonmas Boonyungyuen Contact No. : 08 1906 6678

Email : bwimonmas@yahoo.com and wimonmas.boo@mahidol.ac.th

9.2 Name : Dr. Pensiri Prachakittikul

Email : pensiri.prc@mahidol.ac.th

10. Course Outline

| Week | Date | Contents | CLOs | Instructor's Names |
|------|----------|--|----------|--------------------|
| 1 | 20/01/21 | - Introduction to Course outline and Measurement - Introduction to wastewater characteristics, definitions of wastewater characteristics and the source of waste water - Waste water and environmental impact | 8.1, 8.2 | Dr. Wimonmas |
| 2 | 27/01/21 | - The main component of the wastewater treatment system - Criteria for considering quality and quantity of wastewater for wastewater treatment | 8.1, 8.2 | Dr. Wimonmas |
| 3 | 3/02/21 | - Design of waste water collection system | 8.1, 8.2 | Dr. Wimonmas |
| 4 | 10/02/21 | - Design of waste water pump system | 8.1, 8.2 | Dr. Wimonmas |
| 5 | 17/02/21 | - Design of equipment and machinery related to wastewater treatment systems | 8.1, 8.2 | Dr. Wimonmas |
| 6 | 24/02/21 | - Physical wastewater treatment and type of physical wastewater treatment - Equalization Tank - Coarse Screen, Fine Screen - Grease Traps - etc. - Criteria for design physical wastewater treatment and parameter for design | 8.1, 8.2 | Dr. Pensiri |
| 7 | 3/03/21 | - Chemical wastewater treatment and type of chemical wastewater treatment - Criteria for design chemical wastewater treatment and parameter for design | 8.1, 8.2 | Dr. Pensiri |
| 8 | 10/03/21 | - Chemical wastewater treatment and type of chemical wastewater treatment (cont.) | 8.1, 8.2 | Dr. Pensiri |

| | | | | |
|----|--|---|-----------|---|
| | | - Criteria for design chemical wastewater treatment and parameter for design (cont.) | | |
| 9 | Mid-term Examination (15-19/03/21) | | | |
| 10 | 24/03/21 | - Biological wastewater treatment and type of biological wastewater treatment - Criteria for design biological wastewater treatment and parameter for design | 8.1, 8.,2 | Dr. Wimonmas |
| 11 | 31/03/21 | - Biological wastewater treatment and type of biological wastewater treatment (cont.) - Criteria for design biological wastewater treatment and parameter for design (cont.) | 8.1, 8.,2 | Dr. Wimonmas |
| 12 | 7/04/21 | - Design of sludge removal system - Design of natural treatment | 8.1, 8.,2 | Dr. Wimonmas |
| 13 | 21/04/21 | - Design of disinfection system in the treatment system | 8.1, 8.,2 | Dr. Wimonmas |
| 14 | 28/04/21 | - Case study of waste water treatment system from the establishment - Problems and opportunities for future treatment system development | 8.1, 8.,2 | Special instructor and Dr. Wimonmas and Dr. Pensiri |
| 15 | 28/04/21 (13.00-16.00 น. ชดเชยวัน สงกรานต์) | - Case study of waste water treatment system from the establishment - Problems and opportunities for future treatment system development | 8.1, 8.,2 | Special instructor and Dr. Wimonmas Dr. Pensiri |
| 16 | 5/05/21 | Presentation | 8.1, 8.,2 | Dr. Wimonmas and Dr. Pensiri |
| 17 | Final Examination (13-25/05/21) | | | |

11. 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 | 30 |

| | | | | | |
|------|---------------------|---|----------|------------------------|------------|
| 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 | 30 |
| 11.3 | Quiz / Assignments | - Each 30-min quiz will be given in class and cover the content from the previous weeks. There will be no make-up quizzes. - Each student will receive assignments or Homework by the given deadline. | 8.1, 8.2 | 4,8,11,13 And 3,5,6 | 20 |
| 11.4 | Reports | You will have one week to finish each set of Homework. | 8.1, 8.2 | 16 | 15 |
| 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 |

12. 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.

13. 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, ๒๕๕๘, 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. |