



## Course Syllabus (Academic Year 2020)

School of Interdisciplinary Studies, Kanchanaburi Campus, Mahidol University

1. **Course No. and Title** : KAED 331 Hazardous Waste Management  
**Credit (study hours)** : 3 (3-0-6)
2. **Program Name** : Bachelor of Engineering Program in Environmental Engineering and Disaster Management
3. **Course Module** : Major Required Courses  
**Pre/co-requisite** : KAED 330 (Solid Waste Engineering)
4. **Class Semester** :  1<sup>st</sup> Semester  2<sup>nd</sup> Semester Academic Year 2020
5. **Class Schedule & Venue** : Thursday 09:00 – 12:00, Room 2312, Lecture Building and online via Webex meeting
6. **Class Coordinator** : Dr. Pensiri Prachakittikul Contact No: 086-024-0919  
 Email: pensiri.prc@mahidol.edu

### 7. Course Description

Definition, laws and environmental legislations, classification of hazardous wastes, physicochemical properties, toxicology, types and characteristics of hazardous waste, risk assessment and management, handling and transportation, fundamentals of treatment and disposal processes, stabilization, solidification, land disposal, site remediation.

### 8. Course Objectives / Course Learning Outcomes (CLOs)

No.	Objectives / CLOs	Expected Skills / Knowledge			PLOs
		Specific	Generic	Knowledge	
8.1	Explain the definitions of hazardous waste and characteristics (types, sources, composition) of hazardous wastes	1	1, 3, 4, 5	1, 2	1, 2, 6
8.2	Explain the pathways for transport of hazardous waste in various environments	1	1, 3, 4, 6, 10	1, 4	1, 2, 6
8.3	Identify regulations for the handling, storage, and use of toxic and hazardous materials	1-3	1, 2, 3, 4, 6, 7	1-2	1, 2, 6

No.	Objectives / CLOs	Expected Skills / Knowledge			PLOs
		Specific	Generic	Knowledge	
8.4	Explain the techniques of hazardous waste management, treatment, minimization, and site remediation	2-3	1, 3, 4, 5, 6, 7, 10	1-4	1, 2, 6

## 9. Class Instructor List

9.1 Dr. Pensiri Prachakittikul (PP) Contact No.: 086-024-0919 Email: pensiri.prc@mahidol.edu

## 10. Course Outline

Week	Date	Contents	CLOs	Teaching & Learning	Instructor's Names
1	21/01/2021	<ul style="list-style-type: none"> <li>•Overview Hazardous Waste Management</li> <li>•Definition of Hazardous Waste</li> <li>•Hazardous Waste Acts and Regulations</li> </ul>	1, 3	Lecture, problem practice, discussion, and homework assignment	Dr. Pensiri
2	28/01/2021	<ul style="list-style-type: none"> <li>•Common Hazardous Waste (organic chemistry, solvent, pesticides, explosive, PCB, dioxin, furan, metal, and inorganic nonmetal)</li> </ul>	1, 3		
3	4/02/2021	<ul style="list-style-type: none"> <li>• Properties and classification of Hazardous Waste I: concentration unit, water solubility, density, specific gravity</li> </ul>	1, 3		
4	11/02/2021	<ul style="list-style-type: none"> <li>• Properties and classification of Hazardous Waste II: Characteristics of flammability, explosives, heavy metal, organic material</li> <li>• Quiz I</li> </ul>	1, 3		
5	18/02/2021	<ul style="list-style-type: none"> <li>• Hazardous waste sources/ generators</li> <li>• Regulatory requirements</li> <li>• Waste storage and preparation</li> <li>• Chemical Incompatibility</li> </ul>	1, 3		
6	25/02/2021	<ul style="list-style-type: none"> <li>• Transportation and manifest</li> </ul>	1, 3, 4		

Week	Date	Contents	CLOs	Teaching & Learning	Instructor's Names
		<ul style="list-style-type: none"> <li>Labels and placards</li> <li>Hazardous waste toxicology</li> </ul>			
7	4/03/2021	<ul style="list-style-type: none"> <li>Pathways, fate, and transport of hazardous Waste (release and transport of contaminants in the surface water)</li> </ul>	2		
8	11/03/2021	<ul style="list-style-type: none"> <li>Pathways, fate, and transport of hazardous waste (release and transport of contaminants in the soil, groundwater, and air)</li> </ul>	2		
9	18/03/2021 Mid-term Examination				
10	25/03/2021	<ul style="list-style-type: none"> <li>Hazardous waste management (Pollution prevention, waste minimization, reuse, and recycling)</li> </ul>	4	Lecture, problem practice, discussion, and homework assignment	Dr. Pensiri
11	1/04/2021	<ul style="list-style-type: none"> <li>Treatment and disposal methods (Stabilization and solidification)</li> </ul>	1, 3, 4		
12	8/04/2021	<ul style="list-style-type: none"> <li>Treatment and disposal methods (Physico - chemical processes: stripping, soil vapor extraction etc.)</li> </ul>	1, 3, 4		
13	15/04/2021	<b>Songkran Day (Holiday)</b>			
14	22/04/2021	<ul style="list-style-type: none"> <li>Treatment and disposal methods (Physico - chemical processes: adsorption, oxidation-reduction, advanced oxidation process)</li> </ul> <p>Quiz II</p>	1, 3, 4	Lecture, problem practice, discussion, and homework assignment	Dr. Pensiri
15	29/04/2021	<ul style="list-style-type: none"> <li>Treatment and disposal methods (Thermal treatment: incineration, pyrolysis)</li> </ul>	1, 3, 4		
16	6/05/2021	<ul style="list-style-type: none"> <li>Treatment and disposal methods (land disposal)</li> <li>Site Remediation</li> </ul> <p>Poster presentation</p>	1, 3, 4		

Week	Date	Contents	CLOs	Teaching & Learning	Instructor's Names
17	13/05/2021 Final Examination				
18					

### 11. Course Assessment

No.	Methods / Activities	Regulations	CLOs	Week	Weight Distribution (%)
11.1	Mid-term exam	- Contents (week 1-9) - Closed book	8.1, 8.2	9	35
11.2	Final exam	- Contents (week 11-18) - Closed book	8.1-8.4	19	35
11.3	Quiz	- Contents (TBA) - Closed book	8.1-8.4	4, 13	10
11.4	Assignments/Homework	Homework must be turned in during the class hour in the classroom on the due date.	8.1-8.4	1-8, 9-17	5
11.5	Group Report/ Presentation	TBA	8.1-8.4	18	10
11.6	Class participation	Student must attend class more than 80% of the course.	8.1-8.4	1-8, 9-18	5
				<b>Total</b>	<b>100</b>

### 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 %

### 13. References

- 13.1 เกรียงศักดิ์ อุดมสินโรจน์, ของเสียอันตราย, พิมพ์ครั้งที่ ๑. มหาวิทยาลัยรังสิต , กรุงเทพมหานคร.๒๕๕๓.
- 13.2 Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans: Hazardous Waste Management McGraw-Hill, Inc., Singapore, International Editions, 1994
- 13.3 Richard J. Watts, Hazardous Wastes: Sources, Pathways, Receptors, John Wiley & Sons, Inc., New York; January 1998, ISBN: 0-471-00238-0.

## Note

<b>Specific Skill (SS)</b>	
SS1	Assess quantity and quality of hazardous wastes
SS2	Specify important criteria for suitable and reliable of hazardous waste management
SS3	Identify and safely handle hazardous chemicals
<b>Generic Skill (GS)</b>	
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	Formal and informal communication
GS7	The broad education necessary to understand the impact of engineering solutions in a global,
GS10	economic, environmental, and societal context
GS11	A recognition of the need for, and an ability to engage in life-long learning
<b>Knowledge (K)</b>	
K1	Sources and classification hazardous wastes
K2	Regulations of hazardous waste management
K3	Risk identification method
K4	Environmental unit operation for hazardous waste management
<b>PLOs</b>	
PLO1	Apply environmental engineering principles and knowledge to systematic solutions according to professional standards
PLO2	Apply practical skills in environmental engineering and disaster management to real situations based on academic principles and professional ethics
PLO6	Develop a creative technology in environmental engineering and disaster management