Course Syllabus (Academic Year 2020)

School of Interdisciplinary Studies, Kanchanaburi Campus, Mahidol University

1. **Course No. and Title** : KAED 340 Design of Air Pollution Control System

   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 : None

4. **Class Semester** : 2nd Semester Academic Year 2020

5. **Class Schedule & Venue**: Tuesday 8:00 – 9:30, Room 2217

   Friday 13:00 – 14:30, Room 2216

6. **Class Coordinator**

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7. **Course Description**

ชนิดและแหล่งกำเนิดของมลพิษทางอากาศ ผลกระทบต่อสุขภาพและสิ่งแวดล้อม การเคลื่อนย้ายและการแพร่กระจายของมลพิษทางอากาศ หลักการควบคุมฝุ่นและก๊าซมลพิษ การชักตัวอย่างและวิธีการวิเคราะห์ กฎหมายและข้อกำหนด หลักการและการออกแบบหน่วยควบคุมฝุ่นละอองและก๊าซ การออกแบบระบบระบายอากาศ การเดินระบบและการซ่อมบำรุง

Types of air pollutants and sources; effects on health and environment; meteorological transport; principles of particulate and gaseous pollutant control; sampling and analysis methods; laws and regulations. Principles and design of air pollution control units for particulate and gases; ventilation system design; operation and maintenance.

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

No.	Objectives / CLOs	Expected Skills / Knowledge			Sub-PLOs
		Specific	Generic	Knowledge	
8.1	Be able to describe major air pollutants and its impacts on human health and environment.			/	1.1, 1.2

8.2	Be able to describe concepts on fate and transport of air pollution			/	1.1, 1.2
8.3	Be able to demonstrate air pollution samplings			/	1.1
8.4	Be able to deliver significant laws and regulations related with air pollution management and control in Thailand			/	5.1
8.5	Be able to calculate and design the basic air treatment processes	/		/	6.3
8.6	Be able to calculate and design ventilation system	/		/	6.3
8.7	Be able to exemplify applications of air pollution control systems in real working environment	/			5.5

Program learning outcomes

1.1. Accurately explain basic concept, theories and principles of environmental engineering

1.2. Systematically summarize important issues from collected data

5.1 Integrate economics, social and environmental issues to environmental engineering and disaster management works

6.3 Develop a conceptual model or prototype from fundamental engineering knowledge

5.5. Learn and experience from real working environments and solve engineering problems occurred in organizations or industries

9. Course Outline

Week	Date	Contents	CLOs	Learning method	Instructor
1	19, 22 Jan 2021	-Introduction to course outline, objectives, and assessment -Air Pressure, Air density, Air composition, Air - Air Ventilation for Occupation health and Heat mitigation	8.6	Lecture In-class calculation	AB
2	26 Jan 2021	Fan -Fan characteristic curve -System curve	8.6	Presentation In-class calculation	AB
	29 Jan 2021	Criteria Air Pollutants - Effects -National Ambient Air Quality Standards	8.1 8.4	Presentation	AB

Week	Date	Contents	CLOs	Learning method	Instructor
3	2 Feb 2021	Criteria Air Pollutants (cont)	8.1 8.4	Presentation Submit Homework 1	AB
	5 Feb 2021	Group Discussion	8.3	Presentation	AB
4	9 Feb 2021	Measurement and monitoring of air pollutants, Sampling methods and instruments (1) - Concentration unit - Sampling for ambient air pollution - Sampling for occupation health - Regulation/Standard	8.3 8.4	Presentation	AB
	12 Feb 2021	Measurement and monitoring of air pollutants, Sampling - Sampling for VOCs - Stack Air Sampling (US EPA method 5 and method 6) - Sampling for vehicle exhaust emissions - Regulation/Standard	8.3 8.4	Presentation	AB
5	16 Feb 2021	Meteorology for air pollution control	8.2	Presentation	AB
	19 Feb 2021	Meteorology for air pollution control (cont.)	8.2	Presentation	AB
6	23 Feb 2021	Introduction to Air pollution control technology -Gravity Settling Chamber	8.5	Presentation In-class calculation	AB
	26 Feb 2021	Cyclone	8.5	Presentation In-class calculation	AB
7	2 Mar 2021	Wet scrubber	8.5	Presentation In-class calculation	AB
	5 Mar 2021	Bag house, Bag Filter	8.5	Presentation In-class calculation	AB
8	9 Mar 2021	Group project	8.5	Presentation In-class calculation	AB
	Midterm Examination				

Week	Date	Contents	CLOs	Learning method	Instructor
9	23 Mar 2021	Electronic Precipitator	8.5	Presentation In-class calculation	AB
	26 Mar 2021	Adsorption Biofiltration	8.5	Presentation In-class calculation	AB
10	27 Mar 2021 (3 hr, Sat)	Demonstrate Air sampling	8.7	Presentation & workshop	AB, Needis
11	30 Mar 2021	Absorption	8.5	Presentation In-class calculation	AB
	2 Apr 2021	Condensation Thermal Oxidation	8.5	Presentation In-class calculation	AB
12	9 Apr 2021	Group project	8.5	Presentation In-class calculation	AB
13	24 Apr 2021 (6 hr, Sat)	VOCs inventory in petroleum industry: field experience	8.7	Presentation & workshop	MP, AS
14		Air pollution model: field experience	8.7	Presentation & workshop	MP, AS
15	27, 30 Apr 2021	Group Project Presentation	8.5, 8.7	Presentation In-class calculation Submit Homework 4	AB
	Final Examination				

10. Course Assessment

No.	Methods/Activities	Regulations	CLOs	Week	Weight Distribution
1	Class participation and Class attention	● Student must submit the assignments in time ● Student must attend classes on time > 80% of the course, by CC		All	5
		Student must participate in class activity		All	5

No.	Methods/Activities	Regulations	CLOs	Week	Weight Distribution
2	Assignment	I. Learner must practice the engineering skills from exercises and assignments II. The score will be evaluated according to the quality and details of work by instructors. (Correctness, Determination)	All	Weekly	25
3	Group Project*	I. 2 people per group II. Topic assigned by lecturer III. Exhibit in ED Innovation Day 29-30 May 2021 IV. Grade evaluated by Rubric criteria*	8.5, 8.4	15	25
3	Midterm Examination	III. The exam will be held on schedule. IV. It is **close-book exam** which student can use personal calculator. V. The scope of exam will be cover topics of the 1st-8th week in this course.	All	9	20
6	Final Examination	VI. The exam will be held on schedule. VII. It is **close-book exam** which student can use personal calculator. VIII. III. The scope of exam will cover all topics of this course.	All	16	20
				Total	100

***Group Project topic**

I. Design odor control system for a Chicken farm in Tha Sung, Kanchanaburi

II. Morphology (size and shape) of aerosol in MUKA and potential sources

III. Evaluate efficiency of 10 facial masks in the market for PM2.5 reduction

IV. Estimate changes in efficiency of a standard facial mask with time – How it fit with fabric filter calculation?

V. Estimate efficiency of water springer for ambient PM2.5 removal – How it fit with wet scrubber calculation?

VI. Estimate efficiency of settling chamber for fly ash removal (sugarcane industry)

VII. Design air ventilation system for heat mitigation in a U-dorm, MUKA

VIII. Design the best cyclone separator for cane fly ash removal

Rubric for Group project

Accurately explain basic concept, theories and principles of environmental engineering	Integrate economics, social and environmental issues to environmental engineering and disaster management works	Solve engineering problems occurred in organizations or industries	Express ideas and use appropriate media for communication
10	5	10	5

11. Grading System

Criterion-referenced evaluation

The student performance in overall course will be measured by Criterion-referenced assessment as following table.

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 %

12. References

1. กรมโรงงานอุตสาหกรรม. ตำราระบบบำบัดมลพิษทางอากาศ. ศูนย์บริการวิชาการแห่งจุฬาลงกรณ์มหาวิทยาลัย. พิมพ์ครั้งที่ **1.** กรุงเทพมหานคร. **2547.**
2. ศิวพันธุ์ ชูอินทร์. การเก็บตัวอย่างและตรวจวัดสารมลพิษทางอากาศ.สำนักพิมพ์แห่งจุฬาลงกรณ์

มหาวิทยาลัย.พิมพ์ครั้งที่ **1.** กรุงเทพมหานคร. **2560**

3. รศ.ดร.วันทนี พันธุ์ประสิทธิ์. การระบายอากาศในโรงงานอุตสาหกรรม สำหรับนักสุขศาสตร์อุตสาหกรรมและนักอาชีวอนามัย. พิมพ์ครั้งที่ 2.

4. สภาวิศวกร. ระบบควบคุมมลพิษทางอากาศ. โดยคณะอนุกรรมการมาตรฐานการประกอบวิชาชีพ. **Download http://www.coe.or.th/coe-2/Download/Articles/ENV/CH6.pdf (06/02/2560)**

5. Thedore, L. (2008). Air Pollution Control Equipment Calculations. Wiley.

6. Myer, K. editor (2018). Handbook of environmental engineering. First Edition, Wiley: USA

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13. PLOs (update 26/10/2018)

Program Learning Outcomes	
1	Apply environmental engineering principles and knowledge to systematic solutions according to Professional Standards
2	Apply practical skills in environmental engineering and disaster management to real situations based on academic principles and professional ethics
3	Apply geo-informatics system and information technologies in planning to handle environmental and disaster problems in accordance with academic principles
4	Present, discuss, and transfer knowledge clearly to persons related to professional works according to communication objectives
5	Work as an environmental engineer with other people to solve complicated problems according to economic, social, and environmental issues
6	Design and invent a creative innovation in environmental engineering and disaster management