

18 APR 2018 CC/ 28 MAY 2018 UC

DEPARTMENT OF CHEMICAL ENGINEERING
College of Engineering
University of the Philippines Diliman, Quezon City

COURSE SYLLABUS
ChemE 151 Introduction to Health, Safety, and Environment

A. Course Catalogue Description

1. **Course Number:** ChemE 151
2. **Course Title:** Introduction to Health, Safety, and Environment
3. **Course Description:** Environmental process engineering; health, safety, and environment (HSE) practices in chemical processing plants
4. **Prerequisite:** ChemE 128 Chemical Reaction Engineering and ChemE 134 Particle Technology
5. **Semester Offered:** First Semester
6. **Course Credit:** 3u
7. **Number of Hours:** 3h
8. **Meeting Type:** lecture
9. **Course Goals:** To introduce environmental process engineering and the concept of health, safety and environment (HSE) practice in the context of operating a chemical processing plant, and to discuss risk management in the workplace of a process engineer

B. Rationale

The course provides the necessary background on environmental process, and health, safety, and environment (HSE) that is expected of chemical engineers working in industrial plants. It also covers reactor safety analysis and pollution prevention technologies in relation to chemical processes.

C. Course Outline

1. Course Outcomes (CO)

Upon completion of the course, students must be able to:

- CO 1.** identify chemical process hazards, their potential risks, and mitigating actions;
- CO 2.** determine the impact of industrial activities on the environment and sustainability;
- CO 3.** understand the importance of occupational health in the workplace;
- CO 3.** perform basic risk management of chemical processes;
- CO 4.** specify suitable treatment processes for liquid, solid and gaseous wastes/pollutants; and
- CO 5.** understand the relevance and applicability of environmental regulations and policies.

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Course Outcomes and Relationship to Program Learning Objectives

Course Outcomes	Program Learning Objectives*				
	A	B	C	D	E
Identify chemical process hazards, their potential risks, and mitigating actions					
Determine the impact of industrial activities on the environment and sustainability					
Understand the importance of occupational health in the workplace					
Perform basic risk management of chemical processes					
Specify suitable treatment processes for liquid, solid and gaseous wastes/pollutants					
Understand the relevance and applicability of environmental regulations and policies					

- * **A** Equip students with strong technical education in chemical engineering necessary to succeed in their chosen careers and to become responsive citizens.
B Develop the students' ability to effectively communicate technical information to any audience.
C Train students to function in multidisciplinary teams, manage projects, and take leadership roles in their respective fields.
D Engage students in research, innovation, and life-long learning to identify opportunities, and address issues and challenges in their respective spheres of influence.
E Instill in students a strong commitment to the ethical practice of their profession; to health, safety, and environment; and to service to society.

2. Course Content

Lecture Topics	No. of Hours
Introduction to environmental systems 1. Hydrosphere 2. Atmosphere 3. Lithosphere 4. Biosphere 5. Pedosphere	3
Environmental management and pollution prevention 1. Quality and pollution a. Water b. Air c. Solid 2. Regulations 3. Pollution prevention strategies	9
Long Examination 1	
Introduction to HSE 1. Framework of HSE 2. Case Studies on the importance of HSE	3

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Lecture Topics	No. of Hours
Hazards of chemicals and processes <ol style="list-style-type: none"> 1. Flammable 2. Explosive (fire and explosion) 3. Toxic 4. Carcinogenic 5. Corrosive 6. Radioactive 7. Reactive chemical 	6
Occupational health and safety <ol style="list-style-type: none"> 1. Toxicology 2. Industrial hygiene 3. Ergonomic design for safety 	6
Risk management (chemical process)	3
Long Examination 2	
Treatment technologies <ol style="list-style-type: none"> 1. Water 2. Air 3. Solid 	15
Risk management (environment)	3
Group Project	
Long Examination 3	
Total number of hours	48

3. Course Coverage

Week	CO	TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities	Suggested Assessment Tools
1	4	Introduction to environmental systems <ol style="list-style-type: none"> 1. Hydrosphere 2. Atmosphere 3. Lithosphere 4. Biosphere 5. Pedosphere 	What are environmental systems? What are the interactions between these systems?	lecture, classwork	quiz, homework
2-4	4	Environmental management and pollution prevention <ol style="list-style-type: none"> 1. Quality and pollution <ol style="list-style-type: none"> a. Water b. Air c. Solid 2. Regulations 3. Pollution prevention strategies 	What are the parameters used to measure pollutants? What are the different local environmental laws and regulations? What are the different pollution prevention strategies that must be adopted?	lecture, classwork	quiz, homework
5	1	Introduction to HSE <ol style="list-style-type: none"> 1. Framework of HSE 2. Case studies on the importance of HSE 	What is HSE?	lecture, classwork	Long Examination 1 quiz, group discussion

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Week	CO	TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities	Suggested Assessment Tools
6-7	2	Hazards of chemicals and processes 1. Flammable 2. Explosive (fire and explosion) 3. Toxic 4. Carcinogenic 5. Corrosive 6. Radioactive 7. Reactive chemical	What are the hazards that must be anticipated from working with chemicals?	lecture, classwork	quiz, group discussion
8-9	1	Occupational health and safety 1. Toxicology 2. Industrial hygiene 3. Ergonomic design for safety	What are the standard health and safety practices and guidelines for working in a chemical processing plant?	lecture, classwork	quiz
10	3	Risk management (chemical process)	What is risk management? How is a risk assessment based on identified hazards performed? What are the different risk assessment tools? What are the mitigation controls to be applied in managing the risks?	lecture, classwork	quiz
					Long Examination 2
11-15	4	Treatment technologies 1. Water 2. Air 3. Solid	What is the method for selecting the appropriate technology for treating wastewater and air pollution?	lecture, classwork	quiz, homework
16	3	Risk management (environment)	What is risk management? How is risk assessment based on identified hazards performed? What are the different risk assessment tools? What are the mitigation controls to be applied in managing the risks?	lecture, classwork	quiz, group discussion, group project
					Group Project
					Long Examination 3

4. Course Requirements

1. Long examinations
2. Group project
3. Quizzes
4. Homework

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REFERENCES:

- Crowl, D. A. and Louvar, J. F. (2011). *Chemical Process Safety: Fundamentals with Applications* 3rd Ed. London, UK: Prentice Hall.
- Khan, F. (2017). *Methods in Chemical Process Safety, Volume 1* 1st Ed. MA: Elsevier Inc., Massachusetts.
- Ordoño, E. E. Development of sequential combination of anaerobic-aerobic and ozonation treatments for distillery wastewater from ethanol fermented molasses (Doctoral dissertation). University of the Philippines Diliman. 2013.
- Sanders, R. (2005). *Chemical Process Safety: Learning from Case Histories* 3rd Ed. Singapore: Elsevier.
- Spellman, F. R. (2016). *Handbook of Environmental Engineering*. Boca Raton, FL: CRC Press.
- Theodore, L., Dupont, R. R., and Ganesan, K. (2017). *Unit Operations in Environmental Engineering*. MA: Scrivener Publishing LLC.