ChE 150
Environmental Process Engineering

Course Description: Introduction on environmental systems and impacts of land use and industrial processes; environmental processes; nature, transport and reactions of environmental contaminants; environmental quality management; chemical engineering principles in gaseous, liquid and solid waste treatment; sanitation and public health; waste management; sustainability.

Course Prerequisites: Chem 31, ChE 125, ChE 134

Course Credit: 3.0 units (3 h lecture)

Program Educational Objectives (BS Chemical Engineering)
The program aims to educate students such that three to five years from graduation, they:

1. take leadership roles in their respective fields and/or effectively work in or manage a team;
2. are equipped with the extensive knowledge and relevant skills necessary to succeed in their chosen careers and to become responsive citizens;
3. are able to demonstrate strong research & innovative capability as they recognize and address opportunities and challenges in their respective spheres of influence;
4. have shown strong commitment to the ethical practice of their profession; to health, safety and environment; and service to society.

Course Outcomes
At the end of the course, the student should be able to:

1. Describe environmental systems and impacts of land use and industrial processes
2. Determine the effects of environmental conditions on nature, transport and reactions of contaminants in the environment
3. Specify measures to mitigate environmental impacts of land use and industrial processes
4. Specify suitable treatment processes for liquid, solid and gaseous wastes/pollutants; and
5. Describe strategies for environmental management, waste management, sanitation

Student Outcomes Satisfied by Course Outcomes

[a] Ability to apply knowledge of mathematics and science to solve engineering problems
[c] Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards
[e] Ability to identify, formulate, and solve engineering problems
[f] Understanding of professional and ethical responsibility
[g] Ability to communicate effectively
[h] Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
[i] Recognition of the need for, and an ability to, engage in life-long learning
[j] Knowledge of contemporary issues

Course Content

Week	Topics	Objectives
1	Technology, Society, and Environment	• Explain how human activities affect the environment • Explain the need for environmental protection and sustainability • Identify the role of chemical engineers in environmental sustainability • Describe the pollution prevention hierarchy
2	Pollution and Environmental Health	• Define resource, ecological services, contaminants and pollutants • Discuss the global environmental problems facing modern society • Describe the effects of pollution on health and well-being • Identify local and international laws and treaties pertinent to the environment
	Green Engineering and Sustainability (seminar)	• Define the principles of green chemistry and engineering • Explain the goals and progress of sustainable development • Recognize opportunities for green engineering in process and product design
3	Physico-Chemical Processes in the Environment	• Describe the effects of advection and dispersion in contaminant transport • Describe chemical reactions and partitioning in the environment • Perform mass and energy balances in environmental systems • Calculate estimates of flow and residence times of components in the environment
4	Biochemical Processes in the Environment	• Describe the population dynamics of microorganisms in the environment • Describe the process of biological transformations under aerobic and anaerobic conditions • Identify the flows and processes in biogeochemical cycles of water, C, N and P
	Long Exam 1	
5	Water Quality and Pollution	• Define the physical, chemical and biological parameters of water quality • Describe the sources and impacts of water pollution • Identify relevant laws and regulations in water quality and water resources
6	Overview of Water and Wastewater Treatment (WWT)	• Define the stages of WWT • Describe the collection and preliminary treatment of WWT • Perform basic design of equalization basins for flow and concentration
7	Physical Processes in WWT	• Describe various applications of mass transfer and particle technology in WWT (sedimentation, filtration, aeration, adsorption, ion exchange, etc.) • Perform basic design of sedimentation basins and clarifiers
8	Chemical Processes in WWT	• Describe various technologies involving neutralization, precipitation, oxidation and disinfection in WWT • Perform stoichiometric mass balances on different chemical processes in WWT
9	Biological Processes in WWT	• Describe various technologies of biological WWT • Define operating parameters in activated sludge processes (ASP), such as VSS, MLSS, MCRT, etc. • Perform mass balances on ASP • Identify the effects of flow and kinetic parameters to the performance of ASP
	Long Exam 2	
	Design Project	Given a set of wastewater influent parameters, • Determine treatment objectives appropriate for its end use/disposal

Week	Topics	Objectives
		• Recommend unit operations and their sequence to meet the effluent standards • Perform material (and energy) balances in the process • Calculate equipment sizes/residence times for certain processes
10	Air Quality and Pollution	• Define the physical and chemical parameters of air quality • Describe the sources and impacts of air pollution • Identify relevant laws and regulations in air quality
11	Characteristics of the Atmosphere	• Describe the structure and properties of the atmosphere • Define the processes involved in the vertical and horizontal motion of the atmosphere • Describe the stability and mixing in the atmosphere • Describe the effect of weather on the fate and transport of air pollutants
12	Control of Particulate Matter	• Describe the principles and applications of various technologies for the removal of particulates from gaseous streams • Calculate efficiencies of particulate removal processes • Perform basic design of cyclone separators
13	Control of Gaseous Contaminants	• Describe the principles and applications of various technologies for the removal of volatile organic compounds and other contaminants from gaseous streams • Identify control strategies for emission control in combustion processes
14	Integrated Solid Waste Management (ISWM)	• Define the principles and best practices of ISWM • Identify the generation mechanisms and properties of solid waste • Describe the design considerations for landfills
15	Solid and Hazardous Waste Engineering	• Identify properties which characterize industrial and hazardous wastes • Describe the principles and applications of various technologies (thermal, biochemical) for the conversion and recovery of solid and hazardous wastes
	Final Exam	

Course Assessment

Field Trips/Reaction Papers	10%
Long Examinations (2)	40%
Design Project	25%
Final Exam	25%

Course Policies

1. Class participation, both in-class and online, is highly encouraged. To promote an open atmosphere for discussion, please keep your phones and other unnecessary gadgets away during class time.
2. Everyone should come prepared to class. Not everything will be in the lectures; thus, the recommended pre-lecture videos and readings are expected, if not required.
3. University rules on absence, cheating, dropping and LOA shall apply.
4. The instructor reserves the right to change class policies when deemed necessary.

Grading System

1.00	1.25	1.50	1.75	2.00	2.25	2.5	2.75	3.00	5.00
[92,100]	[88,92)	[84,88)	[80,84)	[76,80)	[72,76)	[68,72)	[64,68)	[60,64)	[0,60)

List of Instructors

Dr. Maria Lourdes Dalida
Dr. Florencio Ballesteros, Jr.
Dr. Analiza Rollon

Prof. Kristian July Yap
Prof. Julie Anne del Rosario
Prof. Jhud Mikhail Aberilla

References

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