SEE4217: WASTE AND WASTEWATER TREATMENT ENGINEERING

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Waste and Wastewater Treatment Engineering

Subject Code
SEE - School of Energy and Environment
Course Number
4217

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
SEE2002 Chemical Sciences for Energy and Environmental Engineers; and
SEE2201 Fundamentals of Environmental Engineering

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

To introduce students to the principles of municipal wastewater and solid waste treatment and management. The students will learn the fundamental concepts in wastewater treatment technologies, hazardous solid waste disposal and management issues related to sludge treatment and disposal. This will also be combined with the process design skills related to both wastewater treatment and sewerage systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the unit processes associated with the municipal solid waste and wastewater treatment systems.	30		x	
2	Explain the principles of wastewater treatment and apply the knowledge in the process design.	30		x	
3	Evaluate the significance and the main technologies associated with hazardous waste treatment and disposal.	20		x	
4	Identify specific pollution problems associated with sludge disposal, contaminated land and landfill.	20		x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Explain key concepts and principles related to waste and wastewater treatment engineering and the design of processes and systems	1, 2, 3, 4	
2	Tutorials	Solidify students' concepts and understanding with practice	1, 2, 3, 4	
3	Field trip	Visit to wastewater and/or sludge treatment facilities	1, 2	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments Several assignments will be given throughout the semester. Through the assignments, students will demonstrate their understanding of the underlying concepts of waste and wastewater treatment, engineering system design and operation.	1, 2, 3, 4	25	
2	Test Students will complete a mid-term test to demonstrate their ability to apply knowledge to analyze and solve problems related to waste and wastewater treatment engineering.	1, 2, 3, 4	25	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Final exam will test students' ability to integrate knowledge learned throughout the course to analyze and solve problems related to waste and wastewater treatment engineering.

Examination duration: 2 hrs
Percentage of coursework, examination, etc.: 50% by coursework; 50% by exam

To pass a course, a student must do ALL of the following:
1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task

1. Assignments

Criterion

Ability to explain concepts, analyze and solve problems related to waste and wastewater treatment engineering

Excellent (A+, A, A-)

Excellent understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Good (B+, B, B-)

Good understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Fair (C+, C, C-)

Acceptable understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Marginal (D)

Marginally acceptable understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Failure (F)

Poor understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

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Assessment Task

2. Test

Criterion

Ability to explain concepts, analyze and solve problems related to waste and wastewater treatment engineering

Excellent (A+, A, A-)

Excellent understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Good (B+, B, B-)

Good understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Fair (C+, C, C-)

Acceptable understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Marginal (D)

Marginally acceptable understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Failure (F)

Poor understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

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Assessment Task

3. Examination

Criterion

Ability to explain concepts, analyze and solve problems related to waste and wastewater treatment engineering

Excellent (A+, A, A-)

Excellent understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Good (B+, B, B-)

Good understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Fair (C+, C, C-)

Acceptable understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Marginal (D)

Marginally acceptable understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

Failure (F)

Poor understanding of concepts and ability to analyze and solve problems related to waste and wastewater treatment engineering

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Part III Other Information

Keyword Syllabus

- Classification, significance of impurities in water and wastewater: suspended and dissolved solids, organic and inorganic, trace contaminants and pathogens.
- Physical methods for removing particulates: screening, sedimentation and filtration.
- Chemical dosing: precipitation; coagulation and flocculation processes; including basic concepts from colloid science; disinfection and chemical oxidation.
- Adsorption and ion exchange.
- Biological processes for wastewater treatment: aerobic and anaerobic. Activated sludge, trickling filters and sludge digestion.
- Process control strategies.
- Examples of flow sheets and unit operations used in treatment plants.
- Sources, types and composition of municipal solid wastes
- Physical, chemical and biological properties of municipal solid waste
- Waste handling, separation, storage and processing at source/collection of solid waste
- Incineration of solid waste for energy generation
- Thermal and biological conversion technologies for waste treatment
- Disposal of solid wastes and residual matter

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Metcalf & Eddy, Tchobanoglous, G., Burton, F. L. and Stensel, H. D. 2013. Wastewater Engineering: Treatment and Resource Recovery (5th ed). McGraw-Hill.

2	Davis, M. L. 2010. Water and Wastewater Engineering: Design Principles and Practice. McGraw-Hill.
3	Thomas Christensen, Solid Waste Technology and Management, John Wiley & Sons, Ltd. 2010.