

# SEE4217: WASTE AND WASTEWATER TREATMENT ENGINEERING

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## Effective Term

Semester A 2025/26

## 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.

### Learning and Teaching Activities (LTAs)

| LTAs |           | Brief Description                                                                                                                              | CILO No.   | Hours/week (if applicable) |
|------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------|
| 1    | Lectures  | Students will learn key concepts and principles related to waste and wastewater treatment engineering and the design of processes and systems. | 1, 2, 3, 4 |                            |
| 2    | Tutorials | Students will engage in exercises aimed at strengthening their understanding of concepts and applying the knowledge covered in lectures.       | 1, 2, 3, 4 |                            |

|   |            |                                                                                                                                                 |      |  |
|---|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|--|
| 3 | Field trip | Students will visit local wastewater and/or waste treatment facilities to learn about the design and real-life operation of engineered systems. | 1, 2 |  |
|---|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|--|

**Assessment Tasks / Activities (ATs)**

|   | ATs                                                                                                                                                                                                                                                     | CILO No.   | Weighting (%) | Remarks ("- " for nil entry) | Allow Use of GenAI? |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------|------------------------------|---------------------|
| 1 | Assignments<br>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            | -                            | Yes                 |
| 2 | Test<br>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            | -                            | No                  |

**Continuous Assessment (%)**

50

**Examination (%)**

50

**Examination Duration (Hours)**

2

**Minimum Continuous Assessment Passing Requirement (%)**

30

**Minimum Examination Passing Requirement (%)**

30

### **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 continuous assessment, examination, etc.: 50% by continuous assessment; 50% by exam

To pass a course, a student must do ALL of the following:

- a. obtain at least 30% of the total marks allocated towards continuous assessment (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
- b. obtain at least 30% of the total marks allocated towards final examination (if applicable); and
- c. 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. Wastewater Engineering: Treatment and Resource Recovery (5th ed). McGraw-Hill. 2013. |
| 2     | Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice (2nd ed.). McGraw-Hill. 2019.                                       |
| 3     | Syed E. Hasan, Introduction to Waste Management. John Wiley & Sons, Ltd. 2022.                                                                           |