

# SEE4218: WATER AND WATER RESOURCE ENGINEERING

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## Effective Term

Semester A 2022/23

## Part I Course Overview

### Course Title

Water and Water Resource Engineering

### Subject Code

SEE - School of Energy and Environment

### Course Number

4218

### 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

SEE1003 Introduction to Sustainable Energy and Environmental Engineering;  
SEE2002 Chemical Sciences for Energy and Environmental Engineers; OR  
SEE2201 Fundamentals of Environmental Engineering

### Precursors

Nil

### Equivalent Courses

Nil

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to introduce the theory and application of physical and chemical processes for the improvement of water quality in engineered water treatment plants and natural aquatic systems. The students will learn to design, engineer and analyze water treatment systems and the energy requirements will be considered. The latest innovative technologies used in water treatment will be discussed.

### Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the water quality standards	10		x	
2	Design and analyze water treatment reactors	30		x	
3	Apply physical processes to improve water quality	25		x	
4	Apply chemical processes to improve water quality	25		x	
5	Analyze the energy demand of treatment systems and understand the latest innovative technologies	10	x	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 basic theories and concepts of water treatment and control	1, 2, 3, 4, 5	2
2	Tutorials	Require students to practice engineering calculation and formulation techniques	1, 2, 3, 4, 5	1
3	Field trip	Broaden students' understanding of concepts through field trip visit to nearby water treatment facilities	3, 4	

**Assessment Tasks / Activities (ATs)**

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments Several assignments will be given to assess student's understanding of the theories and concepts for water treatment, including engineering system design, controls, and operation	1, 2, 3, 4, 5	60	

**Continuous Assessment (%)**

60

**Examination (%)**

40

**Examination Duration (Hours)**

2

**Additional Information for ATs**

Final exam will test students' ability to demonstrate knowledge learned throughout the course to analyze and solve problems related to water and water resource engineering.

Examination duration: 2 hrs

Percentage of coursework, examination, etc.: 60% by coursework; 40% 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 describe the water quality standards and analyze water treatment system

Ability to estimate the energy demand of treatment systems and understand the latest innovative technologies

**Excellent (A+, A, A-)**

Excellent understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Good (B+, B, B-)**

Good understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Fair (C+, C, C-)**

Acceptable understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Marginal (D)**

Marginally understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Failure (F)**

Poor understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Assessment Task**

## 2. Examination

**Criterion**

Ability to provide engineering solutions and to design a water treatment system  
Apply chemical and physical processes to improve water quality

**Excellent (A+, A, A-)**

Excellent understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Good (B+, B, B-)**

Good understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Fair (C+, C, C-)**

Acceptable understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Marginal (D)**

Marginally understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Failure (F)**

Poor understanding of concepts and ability to analyze and solve problems related to water and water resource engineering

**Part III Other Information****Keyword Syllabus**

Water quality standards; properties of water contaminants; reactor theory; mass balances; reaction kinetics; gas transfer; adsorption; particle characterization; particle processes; flocculation; filtration; gravity separations; membrane processes; disinfection; energy demand

**Reading List****Compulsory Readings**

	Title
1	Mackenzie L. Davis (2011) Water and wastewater engineering: design principles and practice. New York : McGraw-Hill.
2	Lawler, D. and M. Benjamin. 2003. Water Quality Engineering: Physical and Chemical Treatment Processes. McGraw-Hill.
3	American Water Works Association and J. Edzwald. 2010. Water Quality and Treatment: A Handbook on Drinking Water, 6th ed. McGraw-Hill.

**Additional Readings**

<b>Title</b>	
1	METCALF & EDDY: AECOM, Inc. (2007) Water Reuse: Issues, Technologies, and Applications, New York: McGraw-Hill, Ltd.
2	David Hendricks (2010) Fundamentals of Water Treatment Unit Processes: Physical, Chemical, and Biological. IWA Publishing, CRC press