SEE4218: WATER AND WATER RESOURCE ENGINEERING

Effective Term
Semester A 2024/25

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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Students will engage in lectures with facilitated discussion to gain basic theories and concepts of water treatment and control.	1, 2, 3, 4, 5	2
2	Tutorials	In tutorials, students will practice engineering calculation and formulation techniques.	1, 2, 3, 4, 5	1
3	Field trip	Students will broaden their understanding of concepts through a field trip 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 continuous assessment, examination, etc.: 60% by continuous assessment; 40% 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 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

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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

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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

	Title
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