SEE8221: WASTEWATER ENGINEERING AND WATER QUALITY ASSESSMENT

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Wastewater Engineering and Water Quality Assessment

Subject Code
SEE - School of Energy and Environment
Course Number
8221

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
SEE6213 Wastewater Engineering and Water Quality Assessment

Exclusive Courses
Nil

Part II Course Details

Abstract

The course aims to provide students with the fundamental knowledge on wastewater engineering processes as well as the analytical techniques involved in assessing water quality. State-of-the-art processes in wastewater treatment will also be covered in the course.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Identify and classify the different sources of wastewater and their requirement for treatment depending on their discharge or final utilisation.	10	x		
2	Describe and perform various analysis of water and wastewater quality assessment.	20		x	
3	Design the various physical and chemical unit operations for wastewater treatment.	20		x	
4	Design the various biological unit operations for wastewater treatment.	20		x	
5	Describe the principles of various advanced treatment, concepts of water recycling and desalination.	30			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	The lectures will cover basic theories and concepts of wastewater treatment and control methods, techniques and operations of waste treatment plants, and management systems commonly use in Hong Kong.	1, 2, 3, 4	2 hrs/week
2	Tutorial	Open discussions in tutorial sessions will be given to students on engineering calculation procedure and formulation techniques.	2, 3, 4	1 hr/week

3	Laboratory	Analysis water quality and understand its impact on environment	2	
4	Field visit	Recognize the contemporary technology at national levels in addressing environment problems and issues	4	
5	Mini projects	Develop innovative and creative solutions to wastewater treatment through teamwork and projects	5	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	2, 3, 4	20	-	Yes
2	Project	5	30	-	Yes
3	Quiz	1, 2, 3, 4	20	-	No

Continuous Assessment (%)

70

Examination (%)

30

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

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

a. 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);
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

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Graded assignment in each topic with both calculations and structured problem solving

Excellent

(A+, A, A-) The student completes all assessment tasks/activities and the work demonstrates excellent understanding of the scientific principles and the working mechanisms

Good

(B+, B, B-) The student completes all assessment tasks/activities and can describe and explain the scientific principles.

Fair

(C+, C, C-) The student completes all assessment tasks/activities and can describe and explain some scientific principles.

Marginal

(D) The student completes all assessment tasks/activities but can only briefly describe some scientific principles.

Failure

(F) The student fails to complete all assessment tasks/activities

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Assessment Task

Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Comprehensive paper examination with both calculations and structured problem solving in evaluating student' s learning abilities

Excellent

(A+, A, A-) He/she can thoroughly identify and explain how the principles are applied to wastewater engineering.

Good

(B+, B, B-) He/she provides a detailed evaluation of how the principles are applied to wastewater engineering.

Fair

(C+, C, C-) He/she provides simple but accurate evaluations of how the principles are applied to wastewater engineering.

Marginal

(D) Only some of the analysis is appropriate to show how the principles are applied to wastewater engineering.

Failure

(F) He/she fails to identify and explain how the principles are applied to wastewater engineering.

Assessment Task

Mini Project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Analyse and provide innovative engineering solution in wastewater treatment

Excellent

(A+, A, A-) He/she is able to communicate ideas effectively and persuasively via written texts and/or oral presentation.

Good

(B+, B, B-) He/she is able to communicate ideas effectively via written texts and/or oral presentation.

Fair

(C+, C, C-) He/she can communicate ideas clearly in written texts and/or in oral presentations.

Marginal

(D) He/she can communicate simple ideas in writing and/or in oral presentations.

Failure

(F) He/she is weak in communicating ideas and/or the student’ s work shows evidence of plagiarism.

Assessment Task

Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Graded assignment in each topic with both calculations and structured problem solving

Excellent

(A+, A, A-) The student completes all assessment tasks/activities and the work demonstrates excellent understanding of the scientific principles and the working mechanisms

Good

(B+, B) The student completes all assessment tasks/activities and can describe and explain the scientific principles.

Marginal

(B-, C+, C) The student completes all assessment tasks/activities but can only briefly describe some scientific principles.

Failure

(F) The student fails to complete all assessment tasks/activities

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Assessment Task

Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Comprehensive paper examination with both calculations and structured problem solving in evaluating student’ s learning abilities

Excellent

(A+, A, A-) He/she can thoroughly identify and explain how the principles are applied to wastewater engineering.

Good

(B+, B) He/she provides a detailed evaluation of how the principles are applied to wastewater engineering.

Marginal

(B-, C+, C) Only some of the analysis is appropriate to show how the principles are applied to wastewater engineering.

Failure

(F) He/she fails to identify and explain how the principles are applied to wastewater engineering.

Assessment Task

Mini Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Analyse and provide innovative engineering solution in wastewater treatment

Excellent

(A+, A, A-) He/she is able to communicate ideas effectively and persuasively via written texts and/or oral presentation.

Good

(B+, B) He/she is able to communicate ideas effectively via written texts and/or oral presentation.

Marginal

(B-, C+, C) He/she can communicate simple ideas in writing and/or in oral presentations.

Failure

(F) He/she is weak in communicating ideas and/or the student’ s work shows evidence of plagiarism.

Assessment Task

Term Project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Capacity for self-directed learning to investigate air and water pollution issues and their impacts on human health and/or well-being

Excellent

(A+, A, A-) Demonstrate excellent self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

Good

(B+, B, B-) Demonstrate good self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

Fair

(C+, C, C-) Demonstrate moderate self-directed learning capacity investigate air and water pollution issues and their impacts on human health and/or well-being

Marginal

(D) Demonstrate basic self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

Failure

(F) Demonstrate poor self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

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Assessment Task

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to explain in detail and with accuracy and apply their knowledge in key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Excellent

(A+, A, A-) Excellent analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the

process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Good

(B+, B, B-) Good analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Fair

(C+, C, C-) Moderate analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Marginal

(D) Basic analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Failure

(F) Poor analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

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Assessment Task

Mid-terms (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to explain in detail and with accuracy and apply their knowledge in key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Excellent

(A+, A, A-) Excellent analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Good

(B+, B, B-) Good analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Fair

(C+, C, C-) Moderate analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Marginal

(D) Basic analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Failure

(F) Poor analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

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Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to explain in detail and with accuracy and apply their knowledge in key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Excellent

(A+, A, A-) Excellent analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Good

(B+, B, B-) Good analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Fair

(C+, C, C-) Moderate analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Marginal

(D) Basic analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Failure

(F) Poor analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

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Assessment Task

Term Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Capacity for self-directed learning to investigate air and water pollution issues and their impacts on human health and/or well-being

Excellent

(A+, A, A-) Demonstrate excellent self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

Good

(B+, B) Demonstrate good self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

Marginal

(B-, C+, C) Demonstrate moderate to basic self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

Failure

(F) Demonstrate poor self-directed learning capacity to investigate air and water pollution issues and their impacts on human health and/or well-being

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Assessment Task

Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Ability to explain in detail and with accuracy and apply their knowledge in key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Excellent

(A+, A, A-) Excellent analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Good

(B+, B) Good analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Marginal

(B-, C+, C) Moderate to basic analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Failure

(F) Poor analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Assessment Task

Mid-terms (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Ability to explain in detail and with accuracy and apply their knowledge in key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Excellent

(A+, A, A-) Excellent analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Good

(B+, B) Good analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Marginal

(B-, C+, C) Moderate to basic analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Failure

(F) Poor analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

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Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Ability to explain in detail and with accuracy and apply their knowledge in key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Excellent

(A+, A, A-) Excellent analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Good

(B+, B) Good analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the

process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Marginal

(B-, C+, C) Moderate to basic analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

Failure

(F) Poor analysis and problem-solving skills in demonstrating their understanding of key concepts related to the scale and process of current air and water pollution problems including the physical and chemical principles related to the process of air and water pollution mathematical and/or computational models to solve air and water pollution formation, transport and dispersion problems

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Part III Other Information

Keyword Syllabus

- Composition and classification of wastewater
- Analytical techniques in water quality assessment
- Physical unit operations – sedimentation, flocculation, flotation
- Chemical unit operations – aeration, pH, chlorination, ion exchange
- Biological treatment – aerobic/anaerobic treatment, activated sludge, trickling filter
- Membrane bioreactor (MBR)
- Advanced oxidation processes – ozone, UV, Fenton, photo-Fenton, photocatalysis
- Water recycling and desalination

Reading List

Compulsory Readings

	Title
1	Metcalf and Eddy /Aecom, Wastewater Engineering: Treatment and Resource Recovery 5th Edition, McGraw-Hill International Edition, 2014.
2	MIHELCIC, J.R. and ZIMMERMAN, J.J. (2009) Environmental Engineering: Fundamentals, Sustainability, Design. New Jersey: John Wiley & Sons, Ltd.

Additional Readings

	Title
1	MACKENZIE , D. (2010) Water and Wastewater Engineering. New York: McGraw-Hill, Ltd.
2	METCALF & EDDY: AECOM, Inc. (2007) Water Reuse: Issues, Technologies, and Applications New York: McGraw-Hill, Ltd.
3	IZRAIL, S., TUROVSKIY, P. and MATHAI, K. (2006) Wastewater Sludge Processing. New Jersey: John Wiley & Sons, Ltd.
4	RUSSELL, D.L. (2006) Practical Wastewater Treatment. New Jersey: John Wiley & Sons, Ltd.