SEE4219: AIR QUALITY MODELING

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Air Quality Modeling

Subject Code
SEE - School of Energy and Environment
Course Number
4219

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
SEE3203 Air Pollution; and
SEE4204 Environmental Systems Modelling

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Air quality models have become fundamental tools to analyze observations, understand relationships, test hypotheses, and project future evolution for air pollution. This course is aimed to provide insight into the methods used in air quality modelling. It will focus on both theory and practice, from the fundamental principles behind models to their applications in interpreting air pollution. Particular emphasis will be the mathematical methods for chemical and physical systems; steady-state dispersion models; Lagrangian transport models; indoor air quality models; chemical transport models; as well as model evaluation.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate knowledge and comprehension of theoretical principles for air quality modeling	50		x	
2	Assess the capabilities and limitations of modelling methods	15	x	x	
3	Evaluate air quality model results and apply them to interpret air pollutants observations	25	x	x	
4	Apply simple model experiments to explain and solve air pollution problems	10		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 discussion to learn key concepts and theories of air quality modelling.	1, 2, 3, 4	3
2	Computational Labs	In computational sessions, students will learn to use classic model software that recommended by Hong Kong EPD to solve simple real-world air pollution problems.	3, 4	3 hours/week for 3-4 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments Assignments will be given throughout the semester. Students will demonstrate their understanding of the underlying mechanisms in air quality modelling and apply simple models to simulate air quality at specific conditions.	1, 2, 3, 4	30	
2	Mid-term Mid-term exam will test students' ability to apply knowledge to analyze and solve problems related to air quality modelling.	1, 2	30	

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Final exam will test students' ability to apply their knowledge learned throughout the course in air quality modelling problems and demonstrate their own understandings on the applications of air quality models.

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 design simulation experiments, analyse and solve problems, related to air quality modeling

Excellent (A+, A, A-)

Excellent analysis, problem solving, and model experiments design skills to demonstrate in-depth understanding of air quality modeling mechanisms and applications.

Good (B+, B, B-)

Good analysis, problem solving, and model experiments design skills to demonstrate good understanding of air quality modeling mechanisms and applications.

Fair (C+, C, C-)
Acceptable analysis, problem solving, and model experiments design skills to demonstrate basic understanding of air quality modeling mechanisms and applications.

Marginal (D)
Marginally acceptable analysis, problem solving, and model experiments design skills to demonstrate limit understanding of air quality modeling mechanisms and applications.

Failure (F)
Poor analysis, problem solving, and model experiments design skills. Failure to demonstrate understanding of air quality modeling mechanisms and applications.

Assessment Task
2. Mid-term

Criterion
Ability to explain concepts, analyse and solve problems related to air quality modeling

Excellent (A+, A, A-)
Excellent understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Good (B+, B, B-)
Good understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Fair (C+, C, C-)
Acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Marginal (D)
Marginally acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Failure (F)
Failure to demonstrate understanding of concepts and solve problems related to air quality modeling.

Assessment Task
3. Examination

Criterion
Ability to explain concepts, analyse and solve problems related to air quality modeling

Excellent (A+, A, A-)
Excellent understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Good (B+, B, B-)
Good understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Fair (C+, C, C-)
Acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Marginal (D)

Marginally acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.

Failure (F)
Failure to demonstrate understanding of concepts and solve problems related to air quality modeling.

Part III Other Information

Keyword Syllabus

- Basic concepts: model equations and numerical approaches; brief review for the emission, transport, and dispersion of air pollutants; trajectory models and their applications; statistical methods; model evaluation and model experiments design.
- Indoor air quality modelling: ventilation systems and indoor air flow; indoor box model; computational fluid dynamics for indoor environment; model applications.
- Outdoor dispersion models: local-scale meteorology; Guassian plume models; puff models; model applications.
- Chemical transport models: chemical system; sub-grid processes; new challenges in air quality modelling.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Modeling of Atmospheric Chemistry, Guy P. Brasseur and Daniel J. Jacob, Cambridge University Press, 2017.