City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2021/22

Part I Course Overview

Course Title:	Air Quality Modeling
Course Code:	SEE4219
Course Duration:	One semester
Credit Units:	3
Level:	B4
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	SEE3203 Air Pollution; and SEE4204 Environmental Systems Modelling
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

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.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Demonstrate knowledge and comprehension of theoretical principles for air quality modeling	50%		✓	
2.	Assess the capabilities and limitations of modelling methods	15%	✓	✓	
3.	Evaluate air quality model results and apply them to interpret air pollutants observations	25%	✓	✓	
4.	Apply simple model experiments to explain and solve air pollution problems	10%		✓	
	** If weighting is assigned to CILOs, they should add up to 100%.*	100%			

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lectures	Lectures	✓	✓	✓	✓	3 hours

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: __60__%						
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.	✓	✓	✓	✓	30%	
Mid-term Mid-term exam will test students' ability to apply knowledge to analyze and solve problems relate to air quality modelling.	✓	✓			30%	
Examination: __40__% (duration: 2 hours , if applicable) 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.						
** The weightings should add up to 100%.*					100%	

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.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	Ability to design simulation experiments analyse and solve problems, related to air quality modeling	Excellent analysis, problem solving, and model experiments design skills to demonstrate in-depth understanding of air quality modeling mechanisms and applications.	Good analysis, problem solving, and model experiments design skills to demonstrate good understanding of air quality modeling mechanisms and applications.	Acceptable analysis, problem solving, and model experiments design skills to demonstrate basic understanding of air quality modeling mechanisms and applications.	Marginally acceptable analysis, problem solving, and model experiments design skills to demonstrate limit understanding of air quality modeling mechanisms and applications.	Poor analysis, problem solving, and model experiments design skills. Failure to demonstrate understanding of air quality modeling mechanisms and applications..
2. Mid-term	Ability to explain concepts, analyse and solve problems related to air quality modeling	Excellent understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Good understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Marginally acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Failure to demonstrate understanding of concepts and solve problems related to air quality modeling.
3. Examination	Ability to explain concepts, analyse and solve problems related to air quality modeling	Excellent understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Good understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Marginally acceptable understanding of concepts and ability to analyze and solve problems related to air quality modeling.	Failure to demonstrate understanding of concepts and solve problems related to air quality modeling

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- 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.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

Nil

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

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