

The Hong Kong University of Science and Technology

UG Course Syllabus

Air Quality Control and Management

ENVR4470 /CIVL 4470

3 credits

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Course Description

Historical and health impact studies related to air pollution. Atmospheric stability and its impact on the transport and dispersion of pollutants. Sources of major air pollutants. Comparison of urban, industrial and transport related air pollution issues, using Hong Kong and Pearl River Delta as examples. Control of stationary and mobile emission sources. Air quality management - framework, policy tools and comparison of different approaches. This course is designed to provide solid foundation of the science, engineering, and basic issues associated air pollution control and air quality management.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Understand the fundamental principles of air pollution;
2. Identify and describe the main sources of emissions that lead to urban air pollution;
3. Compare and contrast the most common methods for effectively preventing or controlling emissions of air pollution;
4. Understand the key issues in connecting science to policy formulation;
5. Evaluate options and strategies for management of air quality;
6. Identify opportunities in addressing air pollution problems with smart city technologies.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Homework	30%	1 week after the assignment *
In-class discussion and activity	5%	at the end of each class
Mid-Term	20%	20/10/2026 *
Group Project	10%	24/11/2026 *
Final examination	35%	15/12/2025

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Homework	ILO1, ILO2, ILO3	Homework assignments are designed to reinforce fundamental concepts and help students critically evaluate air pollution control technologies.
In-class discussion and activity	ILO3, ILO4, ILO5	Activities are interactive and designed to apply knowledge in real-time, often requiring data analysis, brainstorming, discussions and debates.
Mid-Term (open book)	ILO1, ILO2, ILO3, ILO5	The mid-term will assess students' foundational knowledge and the ability to analyze the problems, and provides a checkpoint for understanding key concepts and data analysis before moving on to more advanced topics.
Group Project	ILO4, ILO5, ILO6	The project is comprehensive, involving data analysis, technology evaluation, strategy development, and communication of results. It synthesizes all aspects of the course, allowing students to apply their knowledge in a practical, real-world context.
Final examination (open book)	ILO1, ILO2, ILO3, ILO4, ILO5, ILO6	The final exam will assess the student's overall mastery of the course material, including their ability to analyze, evaluate, and propose solutions to air quality issues.

Grading Rubrics

Detailed rubrics for each assignment will be provided along with the assignments.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.

C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Course AI Policy

Can use the generative artificial intelligence tools to assist the learning, but not directly generating answers to the assessment tasks.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will be provided via Canvas and tutorial sessions in class. Students who have further questions about the feedback including marks should consult the instructor and TAs within five working days after the feedback is received.

Required Texts and Materials

Primary Reference:

1. Noel De Nevers (2000) - Air Pollution Control Engineering. McGraw-Hill International Editions
2. NRC 2012 Exposure Science in the 21st Century: A Vision and Strategy

Secondary Reference:

3. Mark Z. Jacobson (2002) - Atmospheric Pollution, History, Science and Regulation. Cambridge University Press.
4. World Health Organization (<https://www.who.int/>)
5. Hong Kong Environmental Protection Department (<http://www.epd.gov.hk>)
6. EPA 1992 Guidelines for Exposure Assessment Excerpts

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to [Academic Integrity | HKUST – Academic Registry](#) for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

TENTATIVE COURSE SCHEDULE

Week	Topics	Briefly outline what this topic will cover
1	Nature of Atmospheric Pollution	• History and health impact of Air Pollution • Major air pollutants in the atmosphere
2	Fundamentals knowledge of Air Pollution	• Physical and Chemicals • Concentration Units • Unit conversion
3	Air Quality Management strategies	• Air quality management framework • Different management philosophies • Air quality standards • Air quality index
4	Air Quality monitoring and measurement techniques	• Monitoring principles • Measurement techniques
5.	Air Pollution Emission	• Energy Use and Combustion • Emission Sources of Air Pollutants • Emission Inventory and Emission Factors
6.	Air Pollution Meteorology	• Structure and stability of the atmosphere • Mixing, dispersion and transport of air pollutants
7.	Air Quality Models	• Box models • Gaussian models • 3-D gridded models • Receptor models
8.	Air Pollution Control Strategies	• General considerations in air pollution control
9.	Air Pollution Control Technology (1)	• Nature of particulate pollutants • Behavior of particles in the atmosphere • Control of particulates
10.	Air Pollution Control Technology (2)	• Control of Sulfur Oxides
11	Air Pollution Control Technology (3)	• Photochemical air pollution • Control of NO_x and VOCs
12	Indoor Air Pollution and Exposure	• Indoor air quality • Exposure assessment
13	New advances and opportunities	• Crisis and challenges in modern cities • Emerging advances in technologies • New directions in air quality management • Air Quality and Global Climate