MECH4350 Indoor Air Quality in Buildings
(Spring 22-23)

Course Code: MECH4350	**Course Title:** Indoor Air Quality in Buildings
Required Course Or Elective Course: Elective	**Terms Offered (Credits):** Spring (3 credits)
Faculty In Charge: Qiye ZHENG	**Pre/Co-Requisites:** MECH 2310

Course Structure:

Textbook/Required Material:

(1) Class notes, (2) online lecture materials

Reference books:

Zhang Y., Indoor Air Quality Engineering, CRC Press, 2004, ISBN 1-56670-674-2. (pdf version available from the publisher via in HKUST library, Indoor Air Quality Engineering | Yuanhui Zhang | Taylor & Francis eBoo (taylorfrancis.com))

Heinsohn R. and Cimbala J., Indoor Air Quality Engineering, Environmental Health and Control of Indoor Pollutants, Marcel Dekker Inc, ISBN: 0-8247-4061-0 (in HKUST library Reserve)

Hess-Kosa K., Indoor Air Quality, The Latest Sampling and Analytical Methods, Third Edition ISBN 9781315098180 (CRC press 2018, in HKUST Library Reserve)

Bulletin Course Description:

- Indoor air pollutants in buildings and their transport dynamics with respect to building ventilation systems.
- Design methodology in ventilation and filtration for handling indoor air quality in buildings and enclosed spaces.
- Enable student to understand the basic indoor air quality assessment and cleaning methods.

Course Topics:

1. Introduction of Indoor air pollution source and nature
2. Basics on the Mechanics of Particles
3. Deposition, Production, and Resuspension of Airborne Particles
4. Ventilation and HVAC system (Well-Mixed Model)
5. Carbon Dioxide and Human activities
6. Particulate matter PM10, PM2.5
7. Bioaerosol and healthy related matter
8. Indoor air pollutants from combustion
9. TVOC and building materials
10. Radon and ozone
11. Measurement method and instrumentation
12. Filtration mechanism and air cleaners
13. Thermal comfort
14. Indoor air quality and smart buildings

Course Objectives: (correlated program objectives)	1. To provide students with a comprehensive understanding on the critical area of indoor air quality in buildings. The main focus will be the *risks, measurements, and controls* of indoor air pollutants in buildings and enclosed spaces and their basic transport dynamics with respect to the building *ventilation* systems and indoor/outdoor

	flow characteristics [P-O1]. 2. To address pollutant characteristics such as airborne particulate, radon gas and daughters, volatile organic compounds, bio-aerosols. Other areas such as thermal comfort, sick building syndrome and odor theory will be followed [P-O2]. 3. To introduce the various methods in handling indoor air quality in buildings. Ventilation and indoor air quality measurement techniques will be demonstrated [P-O3].
Course Outcomes: (correlated course objectives and program outcomes)	A. The students will have a thorough understanding of the fundamental knowledge and emerging topics in indoor air quality in buildings, including the types and effects of indoor air pollutants, basics of mechanics of airborne particles, the ventilation system designs, etc. through the lectures and group project (1, 2) [POC1, POC2, POC4, POC7, POC8, POC12]. B. Be equipped with knowledge in identifying indoor air quality problems and indoor pollution sources, understand the basic designing principles of ventilation and air cleaning systems and other mitigation strategies in dealing with the practical problems (2, 3) [POC3, POC4, POC5, POC9]. C. Be able to apply building environmental assessment method and modern technology in achieving energy efficient and green building design and operation (3) [POC1, POC4, POC5, POC6, POC7, POC8, POC9, POC10, POC11].
Assessment Tools: (correlated course outcomes)	Homework assignment - 10 % (0-100) Mid term exam - 30% (0-100) Field study and report - 25% (A,B,C) Final Exam - 35% (A,B,C)

BEng in Mechanical Engineering (4-year program)
Program Objectives:

P-O1. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments,
P-O2. Have an international outlook with clear perspectives on the Pearl river Delta and Greater China,
P-O3. Be able to research, design, develop, test, evaluate and implement engineering solutions to problems that are of complexity encountered in professional practice and leadership,
P-O4. Clearly Consider the ethical implications and societal impacts of engineering solutions,
P-O5. Continuously improve through lifelong learning.

Program Outcomes:

POC1. ability to identify and formulate problems in multidisciplinary environment with an understanding of engineering issues and constraints;
POC2. ability to design and conduct experiments as well as analyze and interpret data;
POC3. ability to apply knowledge of mathematics, science, and engineering for problem solving in mechanical engineering and related sectors or for further education in a research career;
POC4. ability to develop specification and to design system, component, or process to meet needs;
POC5. ability to understand the manufacturability, maintainability, and recyclability of engineering system and components;
POC6. ability to use modern engineering tools, techniques, and skills in engineering practice;

POC7. ability to communicate effectively;
POC8. ability to function in multi-disciplinary teams and provide leadership;
POC9. broadly educated with an understanding of the impact of engineering solutions on issues such as economics, business, politics, environment, health and safety, sustainability, and societal context;
POC10. clear understanding of professional and ethical responsibilities;
POC11. recognition of the need for life-long learning and continuing education;
POC12. international outlook with knowledge of contemporary issues.