MECH4350 Indoor Air Quality in Buildings

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: 2 Lectures per week, 1 Tutorial per month, 1.5 hour, 1 final group project (report + in-class presentation)

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. Particulate matter PM10, PM2.5
3. Indoor air pollutants and Human activities
4. TVOC and building materials
5. Basics on the statistics and mechanics of Particles
6. Particle diffusion and related application
7. Deposition, Production, and Resuspension of Airborne Particles
8. Filtration mechanism and air cleaners
9. Measurements and Control of gaseous pollutants
10. Ventilation Techniques and Models

Course Objectives: (correlated program objectives)	1. To provide students with a comprehensive understanding on the critical area of indoor air quality in buildings involving risks and controls of indoor air pollutants in buildings. By the end of this course, students should be able to understand the nature and sources of indoor air pollution, identify common indoor air pollutants such as PM10, PM2.5, and TVOC, and recognize how human activities can affect indoor air quality. [P-O1, P-O3]. 2. To enable student to analyze the statistics and mechanics of

	particles, understand the processes of particle diffusion, deposition, production, and resuspension, and apply this knowledge to real-world scenarios. [P-O3, P-O5]. 3. To introduce the various methods in handling indoor air quality in buildings to allow student to evaluate different filtration mechanisms and air cleaners, measure and control gaseous pollutants, and implement effective ventilation techniques and models to improve indoor air quality. [P-O3, P-O4].
Course Outcomes: (correlated course objectives and program outcomes)	A. Students will gain a comprehensive understanding of both fundamental and emerging topics related to indoor air quality in buildings. This includes knowledge of various types of indoor air pollutants, the basics of particle mechanics and aerodynamics, and the design of ventilation systems. This understanding will be developed through lectures and group projects (1, 2) [POC2, POC4, POC7, POC8, POC12]. B. Students will be equipped with the ability to identify indoor air quality issues and sources of indoor pollution. They will understand the fundamental design principles of ventilation and air cleaning systems, as well as other strategies for mitigating practical problems (2, 3) [POC3, POC4, POC5, POC9]. C. Students will be able to apply building environmental characterization technologies for assessing air quality. They will also understand how to utilize modern filtration and cleaning technologies to achieve and maintain high indoor air quality (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.