Subject Description Form

Subject Code	BSE547
Subject Title	Indoor Air Quality Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	• To understand the rationale for acceptable indoor air quality (IAQ) and impact of IAQ on the comfort, health, productivity and overall wellbeing of building users. • To appreciate the contemporary social-environmental cost implications of IAQ from the perspective of total built environment. • To master the science, engineering design and the management aspects of sustaining an acceptable IAQ. • To integrate IAQ objectives with the total building environmental performances.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. achieve in-depth understanding of factors affecting indoor air quality; b. be competent in designing for acceptable indoor air quality; c. be able to assess and diagnose IAQ in existing buildings, by employing onsite measurements, questionnaire survey and modeling analysis; d. be competent in working across disciplines and with architects, health care professionals, environmental engineers in tackling emerging IAQ issues.; e. be able to implement effective IAQ management in real buildings.
Subject Synopsis/ Indicative Syllabus	Keyword syllabus: **Indoor environment**: Historic perspective of IAQ and its health impacts. Factors affecting indoor air quality, thermal comfort, lighting and noise aspects. Human psychological and physiological aspects. Building related illness (BRI), Sick Building Syndrome (SBS). Children Allergy / asthma, Learning performance and productivity. **Indoor air quality**: Legislation and standards. World Health Organisation (WHO) review of indoor air pollutants of concern. Rationales of Hong Kong Outdoor Air Quality Objective, Hong Kong IAQ certification scheme, and National Ambient Air Quality of US EPA. Health effects and risks of air pollutants. Occupational pollutant exposure standard vs. ambient air quality standard. **Indoor air pollutants**: Gaseous pollutants, Volatile Organic Compounds (VOCs), formaldehyde, radon, airborne particulates and biological contaminants. Modelling analysis of indoor air pollutants: sources and emission strengths, pollutant decay/deposition mechanisms. Aerosol dynamics and Airborne and aerosol infectious disease transmission in indoor environments. **Moisture control and mould / fungi growth indoors**: Introduction to microbiology, life cycle of moulds and mould spore, moisture and humidity dynamics in building space and materials.

Ventilation and indoor air distribution: ASHRAE standard of ventilation, air flow inside and around buildings, ventilation effectiveness, air flow pattern and inhaled air quality, short circuiting of fresh air supply, draft and cold air dumping problems in air-conditioned spaces.

Use of Instrumentation and measurement techniques in IAQ Management: Air change rate measurement, ventilation effectiveness measurement and indoor air pollutant concentration measurement. Emission strength measurement using chamber technique. Procedures of IAQ Audit. Diagnosis of problem buildings.

Air cleaning: Principle of disinfection in air and on surfaces by various techniques and their pros and cons, health impacts – photo-catalytic oxidation, ozone, ultra violet radiation, filtration, plasma and etc.

Control measures: Regulatory control, control techniques, improved IAQ by air-conditioning system design, indoor fitting out and material selection. Removal of indoor contaminants at sources, improved maintenance management.

IAQ management: IAQ management, cross infection control management against communicable diseases.

Teaching/Learning Methodology

- Lectures and tutorials
- Seminars
- Lab visits
- Independent study

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a.	b.	c.	d.	e.
1. Written assignment (Essay)	10%	√	√	√		
2. Small project (15% for seminar and 15% for report)	30%	√		√	√	√
3. Written examination	60%	√	√	√	√	√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The small projects involve more group work, literature review and case study, presentation and in-class discussion, while the written assignment and examination are more analytical and independent. Therefore, they address different aspects of the overall outcome in a balanced way.

Reading List and References	ASHRAE Standard 62.1-2016 (2016), *Ventilation for Acceptable Indoor Air Quality*. Environmental Protection Agency (1991). *Building Air Quality: A Guide for Building Owners & Facility Managers.* Diane Pub. World Health Organization, Environmental Protection Agency (1994). Indoor Air Pollution - An Introduction for Health Professionals, EPA. Indoor Air Quality Management Group (2003). *Guidance Notes for the Management of Indoor Air Quality.* Hong Kong: The Government of the Hong Kong Special Administrative Region. *LEED Reference Guide for Green Building Design and Construction 2009 Edition* (2009). U.S. Green Building Council. SCI Journals: *Indoor Air, Building and Environment, Atmospheric Environment etc.*