CIVIL-460

Indoor air quality and ventilation

Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.
Civil engineering minor	E	Opt.
Environmental Sciences and Engineering	MA2, MA4	Opt.
Mechanics		Opt.
Minor in Integrated Design, Architecture and Sustainability	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

Pas donné en 2024-25

Summary

This course covers the fundamentals of indoor air quality and ventilation strategies for optimal building air quality. Through lectures, discussions, modeling software, a hands-on group project, students explore indoor air pollutants, their properties, emission sources, and control mechanisms.

Content

Indoor gaseous and aerosol pollution properties, sources and concentrations; sick-building syndrome; health effects; mass-balance modelling, CONTAM modelling software, pollutant dynamic behaviour and fate; source control; human exposure assessment; models for predicting source emissions and human exposure; air pollution monitoring; conventional and advanced ventilation strategies; airflow/pollution distribution; infiltration; filtration and air cleaning; ventilation standards.

Keywords

Air quality in buildings, ventilation strategies, airflow distribution, human exposure

Learning Prerequisites

Required courses

None, but familiarity with building physics is recommended

Recommended courses

- Comfort and architecture: sustainable strategies (AR-442)
- Building energetics (ENG-445)
- Building physics I IV (AR PHYS)
- Air pollution and climate change (ENV-400)

Important concepts to start the course

- Building physics

- Fluid dynamics
- HVAC systems
- Indoor environmental quality

Learning Outcomes

By the end of the course, the student must be able to:

- Integrate indoor air quality and ventilation requirements into the building design and operation lifecycle.
- Characterize sources of particle-phase, gas-phase and biological air pollutants in buildings and their impact on human health and well-being.
- Perform basic calculations related to aerosol and gas-phase distribution, and human exposure.
- Assess / Evaluate building air pollution control mechanisms and determine their effectiveness.
- Perform indoor air quality assessment through handling instrumentation and conducting measurements.
- Explore the fundamentals of indoor air quality and airflows modeling software CONTAM.
- Analyze air quality data and prepare oral presentation.

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Access and evaluate appropriate sources of information.
- Make an oral presentation.
- Demonstrate the capacity for critical thinking
- Take feedback (critique) and respond in an appropriate manner.
- Communicate effectively, being understood, including across different languages and cultures.

Teaching methods

This course consists of theory lectures and a group course project that includes hands-on measurements and computer simulations.

Expected student activities

To actively participate in lectures, class discussions, and group projects.

Assessment methods

- Written mid-term exam based on theory: 25%
- Written end-semester exam based on theory: 25%
- Course project and presentation: 50%

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Peer-reviewed papers and websites â## it will be provided throughout the semester

- Spengler, J., McCarthy, J., and Samet, J. Indoor air quality handbook, McGraw-Hill Professional (2001)
- Ott, W., Steinemann, A. C., Wallace, L. A. Exposure Analysis, Taylor & Francis Group (2007)
- Hinds, W. C., Aerosol technology: Properties, behavior, and measurement of airborne particles, Wiley (1999)
- Seinfeld, J. H. and Pandis, S. N., Atmospheric chemistry and physics: from air pollution to climate change, Wiley (2006)
- Awbi, H. B, Ventilation of buildings, E&FN SPON, (2003)
- Etheridge, D., Sandberg, M. Building ventilation - Theory and Measurement, John Wiley & Sons (1996)

Ressources en bibliothèque

- Awbi, H.B, Ventilation of buildings, E&FN SPON (2003)
- Hinds, W.C., Aerosol technology: Properties, behavior, and measurement of airborne particles, Wiley (1999)
- Spengler, J., McCarthy, J., and Samet, J. Indoor air quality handbook, McGraw-Hill Professional (2001).
- Etheridge, D., Sandberg, M.Building ventilation-Theory and Measurement, John Wiley & Sons (1996).
- Steinfeld, J.H. and Pandis, S.N., Atmospheric chemistry and physics: from air pollution to climate change, Wiley (2006)
- Morawska, L. and Salthammer, T., Indoor environment: airbone particles and settled dust Wiley-VCH (2003)

Moodle Link

- https://go.epfl.ch/CIVIL-460

Prerequisite for