Course “Fundamentals of Indoor Climate” (Fall 2025)

Thursday, 17h15 – 19h00; Room: INJ 218

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Office hours: Thursday 16h00 to 17h00, office GC A1 354 or online (by appointment only)

Week	Date	Topics covered	Notes
1	11/09	Introduction to topic/field: • Course introduction • Why do we care about indoor climate?	
2	18/09	Brush up lecture: • Psychometrics: Definitions and charts • Exercise • Heat transfer in buildings	
3	25/09	**Course assignment overview*** Human thermal comfort: • Thermal comfort fundamentals • Human body heat balance • Factors affecting thermal comfort • Quiz	
4	02/10	Human thermal comfort assessment: • Actual thermal comfort • Models (PMV + Adaptive) • Standards requirements • Exercise • Quiz	Course assignment topic selection due
5	09/10	Introduction to HVAC & psychrometric processes • Psychrometric processes in HVAC systems • Examples and exercises Project work and consultations (optional, 10 min)	
6	16/10	Written mid-term exam based on theory (Material from the weeks 1-5)	Venue: CO 3
7	23/10	Fall break (no course)	

8	30/10	Review of the mid-term exam (10 min)
		Indoor air quality
		• Fundamental principles
		• Sources of indoor air pollution
		  • Gaseous pollutants
		  • Particulate matter
		Quiz	

9	06/11	Indoor air quality • Air quality assessment in buildings • Quiz time Project work and consultations	

10	13/10	Introduction to Ventilation:
		• IAQ control overview and definitions
		• Driving forces of ventilation
		• Ventilation characteristics
		• Ventilation requirements
		  • Prescriptive method
		  • Analytical method	

11	20/11	IAQ controls: • Filtration & air cleaning • Class debate (≈½ lecture) Remaining schedule overview and course summary	
12	27/11	**Project work and consultations**	
13	04/12	Written exam based on theory (Material from the weeks 8-11 only)	Venue: CO 3
14	11/12	Course project presentations in class	Final presentations
15	18/12	Course project presentations in class	Final presentations
	19/12	Course project final submission of presentations	by 23:59h

*** Course assignment**

🎯 Purpose

The course project is your chance to **explore one indoor climate topic in depth** and share your findings with the class. You'll work in groups to connect course fundamentals with a **real-world issue or controversy**, and reflect on its **technical, societal, and human implications**.

This project will help you:

- Strengthen your **understanding of core indoor climate concepts**.
- Practice **critical thinking and reflection** (not just summarizing facts).
- Develop skills in **scientific communication** and **visual presentation**.
- Learn how to **find, read, and connect different types of sources**.

👥 Format

- Groups of **4–6 students**.
- A **12-minute oral presentation** with PPT slides.
- Each student should present part of the work.
- If sufficient time, presentations will be followed by **peer and teacher feedback**.

📑 What to include

Your presentation should cover:

1. **Title & authors/presenters**
2. **Motivation & process** – Why did you choose this topic? How did you search for sources?
3. **Introduction** – Key facts about the topic (e.g., a specific pollutant, comfort factor, or building issue).
4. **Technical challenges** – Effects on humans and influencing factors in buildings.
5. **Remedial actions** – Strategies for improvement (engineering, design, behavioral).
6. **Critical reflection** – At least one **limitation, controversy, or unanswered question**.
7. **Conclusions** – Your key takeaways.
8. **References** – Properly cited on slides.

📑 Source requirements

Each group must cite at least:

- **1 research article (peer-reviewed).**
- **1 standard or guideline (e.g., ISO, EN, ASHRAE).**
- **1 news/media article (to connect science to society).**

This **triangulation** encourages you to see the topic from different perspectives.

🔍 Topic selection

Choose from the suggested list or propose your own. To avoid overly broad work, you must frame your topic in a specific context (e.g., building type, region, or scenario).

Building design & passive strategies

- Importance of building massing and orientation for indoor climate (with a case study in a selected country).
- Thermal resistance of building façades and its role in preventing overheating in apartments.
- How the invention of air-conditioning changed architecture and indoor climate worldwide.
- Passive vs. Active: what matters more for good indoor climate in schools?
- Cooling of buildings without air-conditioning – is it feasible in European cities?
- Overheating of buildings: why we should tackle it early in the design of residential housing.

Thermal comfort & human factors

- Thermal comfort in open-plan offices: productivity trade-offs.
- Thermal comfort and productivity: how university lecture halls affect learning.
- Influence of indoor environment on sleep quality – can building engineers help people sleep better?
- Human productivity vs. energy use – are these goals in conflict? (critique with examples).
- Strategies to achieve thermal comfort for all – can we engineer inclusivity?
- Cultural differences in thermal comfort: do global standards fit Swiss vs. Asian contexts?

Indoor air quality & health

- Air humidity and indoor air quality: health impacts in winter vs. summer.
- Impact of indoor air quality on student learning and productivity in classrooms.
- Indoor particles: sources and exposures in urban apartments.
- Why mold grows indoors and how to remediate it: a Swiss housing perspective.
- Condensation in buildings – how to prevent it (case of bathrooms and kitchens).
- Role of indoor climate in combating the spread of airborne viruses in offices.
- Wildfire smoke and IAQ: what can European buildings learn from California?

Ventilation & airflow

- Mechanical vs. natural ventilation – which serves primary schools better?
- Air infiltration in buildings: a friend or a foe for Swiss housing stock?
- Novel ventilation strategies for commercial office buildings.
- Personalized ventilation – future solution or just a niche idea?
- Hybrid ventilation systems: can mixed-mode buildings provide the best of both worlds?

Technology, evaluation & standards

- Are post-occupancy evaluation (POE) surveys enough? Linking occupant feedback with measured health and environmental data.
- Methods to assess indoor climate: strengths and weaknesses, with an example case.
- IoT and low-cost air quality sensors – science tools or just gadgets?
- Do green-certified buildings (e.g., WELL, Minergie) actually deliver better indoor climate?
- Emerging HVAC filtration and air-cleaning technologies: lab vs. real-world performance.
- Future of HVAC in a carbon-neutral world – what stays, what goes?
- Indoor climate and climate change: what will 2050 bring to Swiss cities?

Alternatively, your group may propose its own topic (with teacher approval). Suitable alternatives could include: Highlights of indoor climate topics in the popular media; Reviews of recently published peer-reviewed research articles; Overviews of new or old standards and guidelines; or another contemporary issue connected to thermal comfort, air quality, or building design. All proposed topics should be framed with a specific context (e.g., building type, region, or scenario), and should allow for critical discussion of trade-offs, controversies, or limitations.

📋 **Requirements & tips**

- Use **clear, legible, and visually engaging slides**. Avoid text-heavy slides.
- All external images, data, and quotes must be **properly cited (preferably within a specific slide directly)**.
- Be selective — you cannot cover everything in 12 minutes.
- Rehearse your timing. Presentations running over will be cut off.
- Submit slides (PDF) before or immediately after your presentation day. Naming convention: *GroupX_TitleOfPresentation.pdf*

📜 **Evaluation (35 points total)**

- **Content (15 pts)** – accuracy, depth, appropriate sources.
- **Critical thinking (10 pts)** – reflection on controversies, trade-offs, or open questions.
- **Presentation quality (5 pts)** – clarity, visuals, timing, and structure.
- **Engagement (5 pts)** – ability to present as a group and communicate clearly.