



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Ventilation och luftkvalitet i byggnader Ventilation and Indoor Air Quality in Buildings

ABKN01, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED V

Date of Decision: 2023-03-21

General Information

Main field: Energy-efficient and Environmental Buildings.

Compulsory for: MEMB1

Language of instruction: The course will be given in English

Aim

To give more advanced knowledge about the indoor environment; the factors which influence the indoor environment and how a satisfying indoor environment should be achieved by the design of the technical systems with focus on the ventilation systems.

To give the student knowledge to create buildings which fulfill demands concerning comfort, healthy indoor environment and energy requirements.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be able to understand how a building functions as a climate system
- be able to describe ventilation concepts and all kinds of ventilation systems and other HVAC systems
- be able to understand key concepts about air quality
- be able to describe and have a basic knowledge about where hazardous and other substances may occur in the indoor environment and their effect on humans and environment
- be able to analyze functional requirements, based on human health and comfort, and

air-flow demands for different applications

- be able to describe and explain how to design climatic systems on room level to fulfil all functional requirements
- be able to explain significant factors when creating energy-efficient ventilation systems
- be able to identify dimensioning criteria's for air conditioning and decide air flow rate and air temperature
- be able to understand how different designs and operations of ventilation systems will affect fire-gas spread in a building via the ventilation system in case of fire
- be able to measure basic different indoor climate parameters
- be able to discuss current research trends and challenges in the field of indoor air quality and ventilation

Competences and skills

For a passing grade the student must

- be able to design and dimension HVAC systems to achieve thermally and hygienically satisfying indoor environment, and solve the co-ordination with framework, building envelope and architectural design
- be able to apply computer programs for determination of air flow pattern in rooms and for design of ventilation components
- be able to describe and discuss physical parameters which influence air quality and air distribution in rooms
- be able to calculate pressure drops in ventilation systems and corresponding pressure rise need for the fan
- be able to develop passive strategies for indoor climate control
- be able to perform energy analysis and suggest energy efficiency measures concerning ventilation systems
- show ability for teamwork and cooperation in groups, be able to oral and in written, in dialog with other groups, present and discuss ones results and conclusions
- be able to design a sufficient supply of air to the room by avoiding drafts, high temperature gradient and high concentration of pollutants in the occupied zone, including choosing supply device and its design parameters
- be able to calculate the energy use for the ventilation system in the operating stage and thereby make choices in the design stage on heating and heat recovery systems components for both hygienically and energy-efficient solutions

Judgement and approach

For a passing grade the student must

- be able to realize the need for further knowledge to develop his/her competence
- be able to decide which type of HVAC system to use in a specific building based on which system that can fulfil the technical demands, and be suitable for different conditions; outdoor climate, intended activities and climate demands
- be able to judge, based on the knowledge of the different technical solutions, which systems could be possible and advantageous to apply in a building with very high energy demands
- be able to critically analyse building service design solutions in terms of hygienically, thermal and energy-efficient objectives and to identify faults, risks, and limitations

Contents

The course aims to start with introducing air quality and the substances which may occur in the indoor environment. The known effects on the humans will be described. Demands which fulfil a satisfying thermal and hygienical indoor environment will be elaborated.

The course will continue to deal with technical measures which aim at creating a satisfying indoor environment and a good air quality indoors. The technical solutions include different ventilations systems and other HVAC systems. The design of these systems and its components will be lectured and focus will be given on to explain how the system should be designed in order to achieve a satisfying indoor environment and energy-efficient design solution.

The problem of fire smoke spread via ventilation systems including hazardous substances, high temperatures and poor visibility will be described.

The students will perform exercises including calculation both by hand and computer. The content of the course will be applied in an exercise which the students will work with during the course.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: The final grade is based 70% on the written examination and 30% on the performance related to the exercises and project.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0123. **Name:** Exercise.

Credits: 3. **Grading scale:** UG. **Assessment:** Examination based on written report according to given criteria.

Contents: Design of ventilation system incl. pressure drop calculation.

Code: 0223. **Name:** Written Examination.

Credits: 4,5. **Grading scale:** TH. **Assessment:** Examination based on the written examination. **Contents:** Written examination of the whole course.

Admission

Admission requirements:

- Submitted project assignment in the course AEBN10 Passive house - integrating thermal and moisture issues

The number of participants is limited to: No

The course overlaps following course/s: ABKF10

Reading list

- Abel E, Elmroth A: Buildings and Energy - a systematic approach, T6:2007. FORMAS,

2007, ISBN: 978-91-540-5997-3. Reference Book.

- The Commtech group, editor Nilsson PE: Achieving the desired indoor climate. Studentlitteratur, 2003, ISBN: 91-44-03235-8. Reference Book.
- Course literature will be available through an electronic course library via the course website.
- Lechner, Norbert : Heating, Cooling, Lighting. Sustainable Design methods for Architects. Wiley. , 2014, ISBN: 978-0-470-04809-2. Textbook.
- Yuanhui Zhang: Indoor Air Quality Engineering. CRC Press, 2004, ISBN: 9781566706742. Reference book.
- T. Agami Reddy, Jan F. Kreider, Peter S. Curtiss, Ari Rabl: Heating and Cooling of Buildings: Principles and Practice of Energy Efficient Design, Third Edition. CRC Press, 2016, ISBN: 978-1439899892. Reference book.

Contact and other information

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