LUNDS UNIVERSITET
Lunds Tekniska Högskola

*Course syllabus*

# Kontorsbyggnad - integrering av dagsljus och ventilation
# Office Building - Integrating Daylight and Ventilation Aspects

## AEBN16, 15 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

This course aims to explore innovative daylight utilization and ventilation concepts and concretely apply and test the integration of these principles in case study projects. The course will also allow to explore the potential of daylighting and ventilation constraints as a guide in explorations and development of configurations, technical solutions and detailing. The students will study the potential reduction of energy demand and CO2 emissions in a case study project and learn to use rules of thumb and tools (computer, hand calculations) for daylighting and ventilation predictions (acquired in theoretical courses). Finally, they will learn to obtain extended knowledge of energy balance in a holistic approach including indoor climate; air quality, daylight and lighting, thermal comfort, HVAC systems together with sustainability, building technology, building physics and building services especially for offices.

## Learning outcomes

*Knowledge and understanding*
For a passing grade the student must

- be able to describe and discuss the low energy office concept, its principles and main

strategies;
- demonstrate capacity to discuss daylighting and ventilation aspects of building in relation to building configuration, morphol¬ogy, site, material properties, system selection, detailing, etc.;
- show ability to critically discuss the qualities and characteristics of a low-energy office building project using adequate vocabulary;
- be able to critically discuss the possibilities and limitations to reduce the energy demand when designing office buildings;
- have the capacity to explain how moisture loads combined with cooling affects the moisture conditions in the building;
- be able to name and critically discuss some successful low-energy offices built and renovated in Europe or elsewhere.

*Competences and skills*
For a passing grade the student must

- be able to study, analyse, develop and present a low energy office concept suitable for the cold climatic context;
- show skills to use tools, energy simulations or hand calculations in a productive way for analysing daylighting and ventilation effects of own propositions and guide design decisions;
- demonstrate skills to quantify heat and moisture loads and cooling demand in an office building;
- be able to design building and building components by applying existing computer programs for calculation of energy balance, temperature distribution, power requirement, air flow demands, daylighting, solar shading and moisture conditions;
- be able to design and size an energy-efficient HVAC system which provides good indoor air quality and thermal comfort;
- be able to apply passive strategies for indoor climate control concerning both thermal and moisture aspects;
- be able to communicate in text, verbally and graphically a low energy office concept, using the appropriate vocabulary.

*Judgement and approach*
For a passing grade the student must

- be able to select an adequate, wisely integrated solution leading to very low energy use, good thermal comfort, good indoor air quality and visual comfort in an office project located in a cold climate;
- have the capacity to present and justify the selected solutions using appropriate vocabulary, and fact-based arguments;
- be able to critically analyse design solutions of energy-efficient buildings in terms of air quality, thermal, lighting and moisture related aspects;
- be able to discuss current technical and research trends and challenges related to low energy office buildings in cold climates;
- formulate relevant technical challenges and tasks in relation to low energy office concepts and future development in cold climates.

## Contents

While the residential sector partially witnessed a reduction in energy intensity in the past decades, the energy intensity of office buildings is constantly on the rise in most

industrialized countries due to an increased use of electricity powered equipment (e.g. computer) and also international architectural trends promoting the use of large glass facades. In Sweden, office buildings have experienced a continuous reduction in heating demand following the development of stricter building codes. However, this increased efficiency of the thermal envelope has been accompanied by higher electricity demand for technical services and office equipment. Low-energy building design is not just the result of applying one or more isolated technologies. Rather, it is an integrated whole-building process that requires concerted action on the part of the project team throughout the entire project devel¬opment process. The whole-building approach is easily worth the time and effort, as it can save 30% or more in energy costs over time compared to a conventional building design.

This course is a hands-on, practical course focused on office building design, where principles and strategies of daylight utilization and different ventilation concepts will be explored in depth in addition to already mastered principles of thermal design (heat conservation, moisture and solar protection). The project will be focused on designing a new office building. This practical course will be strongly and rigorously supported by the two theoretical courses “AEBN25 Daylighting and Lighting of Buildings” and “ABKN01 Ventilation and Indoor Air Quality in Buildings ”. The theoretical courses will provide the scientific and technical bases as well as tools (computer, hand calculations) for validating the design propositions developed in the practical course.
However, some lectures on e.g. tools and methods or other topics may be inserted within the practical course when judged necessary under the process.

The students will in groups design an office building considering the energy-efficiency, sustainability, indoor climate and air quality. The content will include qualitative and quantitative methods to achieve a long term satisfactory result. An extensive report shall be delivered at the end of the course. The results will be presented orally and critically reviewed by other students.

## Examination details

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)
**Assessment:** Active participation and attendance at lectures, tutorials, group meetings, presentations etc is compulsory. The final grade is to 70% based on the written report, to 20% based on the oral presentation and to 10% on the opposition to other's work.

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.

## Admission

**Admission requirements:**

- Submitted exercises in the courses "Daylighting and Lighting of Buildings" and "Ventilation and Indoor Air Quality in Buildings"

**The number of participants is limited to:** No
**The course overlaps following course/s:** AEBN15

## Reading list

- Course literature will be available through an electronic course library via the course website.

## Contact and other information

**Course coordinator:** Marie-Claude Dubois, marie-claude.dubois@ebd.lth.se
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