



Faculty of Health, Science and Technology  
Environmental and Energy Systems

# Syllabus

## Thermal and Fluid sciences for building and construction engineers

<b>Course Code:</b>	EMG191
<b>Course Title:</b>	Thermal and Fluid sciences for building and construction engineers <i>Värme- och strömningslära för byggingenjörer</i>
<b>Credits:</b>	10
<b>Degree Level:</b>	Undergraduate level
<b>Progressive Specialisation:</b>	First cycle, has only upper-secondary level entry requirements (G1N)

**Major Field of Study:**  
MEI (Environmental and Energy Systems)

### Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2023-02-01, and is valid from the Autumn semester 2023 at Karlstad University.

### Prerequisites

General admission requirements plus upper secondary level Mathematics 3c/Mathematics D, Physics 2, and Chemistry 1

### Learning Outcomes

The aim of the course is to present basic thermal and fluid science related to the energy systems of buildings.

Upon completion of the course, students should be able to:

- give an account of the Swedish energy system as regards supply, conversion, and use of energy,

- apply mass and energy balances to construction-related systems,
- calculate heat transfer through plane and circular layers,
- calculate heat transfer via conduction, convection and radiation,
- calculate the power and annual energy requirements of a building using Excel (or similar software),
- analyse the annual energy balance of a building and suggest measures for increased efficiency,
- give an account of the significance of solar radiation for the heating and cooling requirements of a building,
- give an account of the function of a heating system in a building,
- describe the function of a ventilation system in a building,
- explain the difference between hydrostatic and hydrodynamic concepts of pressure,
- explain the difference between laminar and turbulent flow,
- apply and interpret the continuity equation and Bernoulli's extended equation in calculations,
- describe and apply different methods for measuring the pressure of fluids,
- describe the function and efficiency of a heat pump or cooling system based on a black-box model, and
- calculate the power requirements for pumps, fans, and heat pumps.

## **Content**

The course covers the following:

- the Swedish energy system
- electricity and heat production plants
- efficiency
- energy and power
- mass and energy balances
- systems and system demarcation
- calculations in Excel or similar software
- cooling machines
- conduction, convection, and radiation
- energy efficiency improvements
- hydrostatics
- hydrodynamics
- concepts of pressure
- the continuity equation
- Bernoulli's extended equation
- flow measuring
- heat pumps
- heat transfer
- ventilation
- problem-solving methodology
- thermal and fluid engineering laboratory sessions
- project using Excel (or similar software) for calculations

**Reading List**

See separate document.

**Examination**

Assessment is based on an individual oral and written hand-in assignment based on Excel (or similar software) and a written exam.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

**Grades**

One of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) is awarded in the examination of the course.

**Quality Assurance**

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

**Course Certificate**

A course certificate will be provided upon request.

**Additional information**

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.