

**SYLLABUS**

# **Advanced Heat and Mass Transfer 7.5 credits F7012T**

**Mass- och värmetransport**

**Course syllabus admitted: Autumn 2023 Sp 1 - Present**

**DECISION DATE  
2022-02-14**

# Advanced Heat and Mass Transfer 7.5 credits F7012T

## Mass- och värmetransport

### Second cycle, F7012T

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Energiteknik	Energy Technology

### Main field of study

Mechanical Engineering

## Entry requirements

Basic knowledge in thermodynamics about heat, energy, energy conservation, etc., which are available, for example, in F0004T, Physics 1, 7.5 credits. Students are also expected to have knowledge of differential and integral calculus, which are available, for example, in M0047M, Differential Calculation, 7.5 credits. Good knowledge in English equivalent to English 6.

## Selection

The selection is based on 30-285 credits

## Course Aim

### 1. Knowledge and understanding:

- Identify, explain, exemplify and illustrate the heat transfer modes and the corresponding theories for quantifying heat transfer flux and rate.
- Identify, explain, exemplify and illustrate different areas and significance in engineering applications.
- Identify and explain the dimensioning of heat exchangers based on the theories of conduction, convection and radiation.

### 2. Skill and ability:

- Formulate the heat equation by using the law of energy conservation to a differential control volume combined with the knowledge of energy crossing the boundaries.
- Identify and apply the correct heat equation and combine with reasonable assumptions and simplifications as well as initial and boundary conditions and energy conservation to solve one-dimensional steady-state conduction problems.
- Perform reasonable assumptions, identify and apply the correct equations to solve two dimensional stationary conduction problems and transient conduction problems using empirical methods.
- Formulate one-dimensional natural and forced convection models based on the boundary layer theory as well as laminar and turbulent flow.
- Understand and analyze phase transformation phenomena such as boiling and condensation based on the theory of vessels and film boiling and laminar and turbulent film condensation.
- Clarify radiation and apply the surface radiation concept to study radiation exchange between black bodies and gray surfaces.

### 3. Judgment and Attitude:

- Be able to determine which simplifications and assumptions can be made to solve heat transfer problems, and how it will affect the results.
- Have the ability to discuss from engineering aspects, understand the need for new knowledge in the energy area and acknowledge the challenges the energy area faces.

## Contents

- Conduction (steady-state, transient) for different geometries;
- Convection (laminar and turbulent boundary layers, natural and forced convection);
- Phase change (boiling, condensation, evaporation);
- Heat exchangers (configurations, log mean temperature difference and epsilon-NTU methods);
- Radiation (black body, real surface, view factor, radiation exchange).

## Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

Lecturing: theoretical explanations & example illustrations.

Self-study: theory study, suggested home-assignments, compulsory home-assignments with bonus.

## Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Written examination with different grades (3, 4, or 5).

## Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

## Overlap

The course F7012T is equal to MTM137

## Course offered by

Department of Engineering Sciences and Mathematics

## Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Written exam	G U 3 4 5	7.5	Mandatory	A21	

## Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

## Last revised

by Niklas Lehto, Programme Director 2022-02-14

## Syllabus established

The syllabus was established by the Department of Applied Physics and Mechanical Engineering 2007-02-28, and remains valid from autumn 2007.