

**Module Description, available in: EN**

# *Thermal Hydraulic Methods for Energy Systems in Buildings and other applications*

**General Information****Number of ECTS Credits**

3

**Module code**

TSM\_HydMeth

**Valid for academic year**

2024-25

**Last modification**

2022-01-03

**Coordinator of the module**

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**Explanations regarding the language definitions for each location:**

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne	Lugano	Zurich
<b>Instruction</b>			X E 100%
<b>Documentation</b>			X E 100%
<b>Examination</b>			X E 100%

**Module Category**

TSM Technical scientific module

**Lessons**

2 lecture periods and 1 tutorial period per week

**Entry level competences****Prerequisites, previous knowledge**

Basic knowledge of thermodynamics, heat transfer and fluid dynamics.

**Brief course description of module objectives and content**

The course imparts knowledge on practical design methods for thermal energy systems such as heating and cooling circuits, solar thermal systems, large extensive pipe networks, and heat pump evaporators. Special emphasis is placed on the conditions for safe operation. The design and integration of storage tanks and heat pumps into thermal networks is also covered. Furthermore, building physical aspects and practical rules regarding pipe routing, building integration, and maintenance are discussed as well. You will find more information [here](#):

## Aims, content, methods

### Learning objectives and acquired competencies

Practical design problems are best solved in a holistic approach. It is therefore advantageous to solve thermodynamic and hydraulic dimensioning problems in conjunction. This approach is expressed by the term "thermal hydraulics". As you will see, thermal hydraulic methods constitute a powerful toolset for the design of energy efficient, cost effective as well as maintenance friendly thermal energy systems and their components.

Through numerous examples, you will learn how to derive analytical models and how to translate them into practically applicable computer codes, which form the basis of the toolsets. You will use this toolset to solve thermal hydraulic engineering problems.

### Contents of module with emphasis on teaching content

A short introduction into thermodynamics, fluid mechanics as well as mass and heat transfer will be given, tailored to the needs of this course. The theory of two-phase flow is taught to the degree necessary to deal with ventability of pipe networks, stagnation of solar thermal plants, and refrigerant evaporators.

Free open-source computer programmes are provided for each topic. You can use them to solve the exercises, and in your future professional practice.

### Teaching and learning methods

The content is presented by frontal teaching.

Numerous examples are motivated by use-cases and illustrated by story-telling.

Homework exercises are solved using the provided VBA codes running under Excel.

### Literature

The script is provided in the form of Powerpoint presentations, scientific articles and literature extracts.

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

**As a rule, all the standard final exams for modules and also all resit exams are to be in written form**

### Standard final exam for a module and written resit exam

#### Kind of exam

written

#### Duration of exam

120 minutes

#### Permissible aids

*Aids permitted as specified below:*

#### Permissible electronic aids

Own Laptop, pocket calculator.

#### Other permissible aids

Open book (Slides, Lecture notes, Exercises)

### Special case: Resit exam as oral exam

#### Kind of exam

oral

#### Duration of exam

30 minutes

#### Permissible aids

No aids permitted