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

Ralph Eismann (FHNW, ralph.eismann@fhnw.ch)

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		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**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 competencies to be acquired

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.

Module content with weighting of different components

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 standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

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 exam

Duration of exam

30 minutes

Permissible aids

No aids permitted