MASTER OF SCIENCE
IN ENGINEERING

Module Description, available in: EN

Thermal Hydraulic Methods for Energy Systems in Buildings

General Information

Number of ECTS Credits

3

Module code

TSM_HydMeth

Valid for academic year

2023-24

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 systems such as heating and cooling circuits, solar thermal systems and district networks. 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.

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”.

The students will learn how to solve thermal hydraulic engineering problems in the fields of building technology, solar thermal energy and thermal network design.

The aim of these methods is to enable the design of energetically and economically efficient as well as maintenance friendly technical components and systems, and, to prove their functionality by way of simulation.

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 the ventability of pipe networks and the stagnation safety of solar thermal plants.

Open source computer programmes are provided for each topic. These assist in solving the exercises and can also be used for the future professional practice.

Teaching and learning methods

The content is taught in frontal lessons.
Numerous examples are motivated 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 ppt-presentations.

Further reading:

Massoud, M., 2005, "Engineering Thermofluids", Springer-Verlag, Berlin, Heidelberg, New York. https://doi.org/10.1007/b138870

Eismann, R., 2017, "Thermohydraulische Dimensionierung von Solaranlagen : Theorie und Praxis der kostenoptimierenden Anlagenplanung", Springer Vieweg, Wiesbaden. ISBN: 978-3-658-07124-0. https://doi.org/10.1007/978-3-658-07125-7

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

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