Module Description, available in: EN

Fluid Mechanics and Heat Transfer

General Information

Number of ECTS Credits

3

Module code

TSM_FMechHeat

Valid for academic year

2024-25

Last modification

2021-04-07

Coordinator of the module

Ricardo Lima (HES-SO, ricardo.lima@hesge.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

Brief course description of module objectives and content

At the beginning of the course, we will give the students an insight on the basics of fluid dynamics and heat transfer.

Subsequently, the course will focus on more complex thermal and fluid phenomena occuring in mechanical engineering applications.

Aims, content, methods

Learning objectives and competencies to be acquired

The objectives of the course are the following:

- To give students a solid knowledge of fluid mechanics and thermal phenomena in order to be able to develop a critical approach with respect to complex mechanical and energetic systems
- To train students at the development of fluid and energetic systems
- To enable students to understand, analyse and realise complex thermal and fluid systems

Module content with weighting of different components

- Navier-Stokes and Bernoulli equations: Starting from mass, energy and momentum conservation laws, the basic fluid mechanics equations are presented
- Vaschy-Buckingham theorem: Different applications will be presented, with the aim of introducing fundamental adimensional numbers (Reynolds, Strouhal, Mach number, etc.) for basic phenomena in both gas and liquid phases (e.g. tip speed ratio for wind mills, pressure drops in pipes, hydraulic machines)
- Basic fluid phenomena
    - Turbulent and laminar flows
    - Wall flows (boundary layers and duct flows); head losses (generalization of Bernoulli theorem)
    - Flow-induced forces (lift, drag and moments) for different geometries (wing profiles and 3D wings; blunt bodies)
    - Laminar or turbulent separation
- Basic thermal phenomena
    - Conduction, convection and radiation
    - Heat exchange (Nusselt, Reynolds and Prandtl correlations)
- Heat exchangers (performance evaluations, geometries)
- Basics of fluid and thermal systems simulations (e.g. heat exchangers and simple heating networks)
- Advanced phenomenological analysis
    - Unsteady phenomena
    - Compressible flows

Teaching and learning methods

Literature

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

No aids permitted

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted