GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Heat and Flow Engineering (E037020)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings in academic year 2026-2027

A (semester 2)	Dutch	Gent

Lecturers in academic year 2026-2027

Beyne, Wim	TW08	lecturer-in-charge
Degroote, Joris	TW08	co-lecturer

Offered in the following programmes in 2026-2027	crdts	offering
Bachelor of Science in Engineering(main subject Electromechanical Engineering)	6	A
Bridging Programme Master of Science in Mechanical and Electrical Systems Engineering	6	A

Teaching languages

Dutch

Keywords

energy, heat transfer, conduction, convection, radiation, evaporation, condensation, multi-phase flow, shock, expansion, vortex, transition, separation

Position of the course

This is the third course in the learning line thermo-fluids.

Contents

- Conductive heat transfer: basic law non-stationary conduction, multidimensional stationary and non-stationary conduction
- Convective heat transfer: convection coefficient, Nusselt number, forced convection, free convection, correlations
- Radiative heat transfer: basic laws, black and real body, inter-surface radiation, gas radiation
- Boiling: phenomenon, pool boiling, nucleate boiling, flow boiling
- Condensation: phenomenon, film condensation, droplet condensation, direct contact condensation
- Two-phase flow of gasses and liquids: flow regimes, pressure drop
- Experimental methods in fluid mechanics: Pitot tubes, hot wire, optical flow measurement techniques
- One-dimensional flows: sound wave, shock wave, compressible flow in tube with variable section, friction, heat transfer
- General equations for an ideal fluid: transport of vorticity, vortex, force on an object
- Steady incompressible potential flow: flow around a cylinder, Magnus effect, flow around flat plate with incidence, lift force of airfoil, induced drag of a finite wing
- Steady compressible flow: perturbation potential for subsonic and supersonic flow, supersonic flow with two-dimensional expansion waves and oblique shock waves, transonic flow
- Turbulence: transition to turbulence, diffusors, separation

Initial competences

- Transport Phenomena
- Technical Thermodynamics

Final competences

1 Understand and calculate different types of heat transfer (conduction,

convection, radiation)
2 Identify, describe and calculate heat transfer with phase change (evaporation, condensation)
3 Explain the influence of compressibility of the fluid on a flow
4 Calculate one-dimensional and two-dimensional flow with a compressible fluid

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Extra information on the teaching methods

- The theory is taught in lectures.
- Exercises are made by the students, guided by a teaching assistant.

Study material

Type: Syllabus

Name: Course notes (Dutch/English)
Indicative price: Free or paid by faculty
Optional: no

Type: Slides

Name: Slides (English)
Indicative price: Free or paid by faculty
Optional: no

References

- A heat transfer textbook, John H. Lienhard V, Phlogiston press, 2019
- J. Anderson. Modern compressible flow, with historical perspective. McGraw-Hill. ISBN 0070016747.
- F. White. Viscous fluid flow. McGraw-Hill. ISBN 0070697124

Course content-related study coaching

- Interactive support through the electronic learning platform (forums, e-mail), in person: after agreement on date, fixed contact hour: immediately before and after lectures.
- Additional guidance by assistant for exercise classes.

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment, Written assessment

Examination methods in case of periodic assessment during the second examination period

Oral assessment, Written assessment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

- Theory: oral exam (closed book)
- Exercises: written exam (open book)

Calculation of the examination mark

The end score (S) is determined as: S = 0.5*T + 0.5*E, with T the score for the theory exam and E the score for the exercises exam.