GHENT UNIVERSITY

Course Specifications

From the academic year 2023-2024 up to and including the academic year

Heat and Combustion Engineering (E037010)

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

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	Dutch	Gent	lecture

Lecturers in academic year 2024-2025

Lecompte, Steven	TW08	lecturer-in-charge
Verhelst, Sebastian	TW08	co-lecturer

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Science in Engineering(main subject Electromechanical Engineering)	6	A

Teaching languages

Dutch

Keywords

energy, heat transfer, conduction, convection, radiation, evaporation, condensation, heat exchangers, combustion, combustibles, combustion technology

Position of the course

This course is situated in the third bachelor year of electro-mechanical engineering. The course builds upon basic knowledge of thermodynamics, chemistry and transport phenomena. It provides the knowledge on heat transfer and combustion techniques, with associated basic technological implemntations as applied in e.g. thermal power plants, cooling cycles, heat pumps, heat recovery, industrial burners, boilers and combustion engines.

Contents

- Energy equation;
- Conductive heat transfer: Basic law - non-stationary conduction, Multidimensional stationary conduction, Multidimensional non-stationary conduction, Numerical methods, Technological aspects;
- 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
- Heat Transfer in Heat exchangers: Introduction LMTD and epsilon-NTU
- Combustion: Phenomenon, Stoichiometry, Flame types, Turbulent flames, Combustion of solid fuels
- Global chemical aspects of combustion: exhaust gas compositition, technical calculations of flow rates and composition of exhaust gases, exhaust gases dew point
- Global chemical aspects of combustion: heating value of a fuel, adiabatic flame temperature, exhaust gas temperature, heat balance of installations
- Emissions: NOx, Combustible species, CO2
- Examples of combustion technology
- Fuel properties

Initial competences

This course builds on the learning outcomes of the course 'Transport phenomena'.

Final competences

1 To be able to identify types of heat transfer and combustion in practical applications
2 Understand and calculate different types of heat transfer (such as conduction, convection, radiation)
3 Being able to identify, describe and calculate heat transfer with phase change (evaporation / condensation)
4 To be able to characterize and calculate the thermodynamic aspects of combustion and different flame types.
5 Know the most important technical properties of fuels.
6 Calculate exhaust gas composition and enthalpy of a furnace.
7 Know the formation mechanisms, consequences and basic countermeasures for harmful emissions, as well as principles related to emissions legislation

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

Lecture

Extra information on the teaching methods

The theory is taught as hearing classes. Excercises are made by the students, guided by a teaching assistant.

Study material

None

References

- An Introduction to Combustion, Stephen R Turns, 2001
- A heat transfer textbook, John H. Lienhard V, Phlogiston press, 2019

Course content-related study coaching

Interactive support through the electronic learning platform (forums, e-mail), in person: after agreement on date, fix contact hour: immediatelt before and after hearing classes. 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.