Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course Specifications
Valid as from the academic year 2019-2020

Thermodynamics, Heat and Mass Transfer (E039160)

Course size
(nominal values; actual values may depend on programme)
Credits 6.0 Study time 180 h Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2019-2020
A (semester 1) English UGent on campus lecture 30.0 h
on campus seminar: 30.0 h
coached exercises

Lecturers in academic year 2019-2020
Stankovic, Ivana TW14 lecturer-in-charge
Maragkos, Georgios TW14 co-lecturer

Offered in the following programmes in 2019-2020
Postgraduate Studies in Fire Safety Engineering
6 A
crds offering

Teaching languages
English

Keywords
first law of thermodynamics, equation of state, combustion, conduction, convection, radiation, mass transfer

Position of the course
This course is situated in the first year of the program. The course provides the scientific basis of the thermodynamics processes, combustion, heat transfer and mass transfer occurring in case of fire. The course supports the key competence of the education program: to master the scientific knowledge in order to understand, to evaluate critically and to analyse the fire phenomenon and its consequences.

Contents
Thermodynamics:
• First Law of Thermodynamics: conservation of energy
• Properties of Pure Substances: phase diagram, equation of state, ideal gas
• Real Gas Mixtures: saturated and unsaturated mixtures
• Second law of thermodynamics
Thermochemistry:
• Flue Gas Composition: combustion chemistry, air factor, combustion with moist air, triangle diagram, flue gases dew point
• Flame Temperatures: enthalpy of formation, heat of combustion, adiabatic flame temperature, flue gas temperature
Heat Transfer:
• Conduction: Basic law, multi-dimensional conduction, unsteady conduction
• Introduction to the Navier-Stokes equations
• Convection: Basic law, Convection coefficient - Nusselt number, forced convection, natural convection
• Radiation: Basic laws, Black and real body, Inter-surface radiation, Gas radiation
Mass Transfer: continuity equations, Fick's law

Initial competences
To have basic knowledge of mathematics, physics, chemistry and transport phenomena.

Final competences
1 Understand and apply the first law of thermodynamics.
2 Quantify thermodynamic properties of pure substances and mixtures.
3 Understand the thermodynamic aspects of combustion.
4 Calculate flue gas temperature and composition in case of combustion.
5 Understand the mathematical formulation of the physical processes of heat transfer.
6 Understand and calculate the consequences of heat transfer in case of fire.
7 Solve a new complex problem, involving the thermodynamic processes and the different modes of heat transfer that occur in case of fire.
8 Recognize the occurrence of mass transfer in case of fire.

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
On campus lecture, on campus seminar: coached exercises.

Extra information on the teaching methods
The theory is taught as hearing classes. Exercises are made by the students, guided by a teaching assistant.

Learning materials and price
- Handouts of slides
- Book: Fundamentals of momentum, heat and mass transfer, J.R. Welty, C. E. Wicks, R. E. Wilson, G. Rorrer.

References

Course content-related study coaching
Interactive support through the electronic learning platform (Ufora, e-mail), in person: after agreement on date, fix contact hour: immediately before and after hearing classes. Additional guidance by assistant for exercise classes.

Evaluation methods
end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period
Written examination, oral examination

Examination methods in case of periodic evaluation during the second examination period
Written examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation
not applicable

Extra information on the examination methods
- Oral examination with written preparation (closed book): a number of questions evaluate the student's understanding of the knowledge obtained in the hearing classes.
- Written examination (open book): a number of new, complex problems require calculation by the student.
- In the second examination period, the corresponding oral examination from the first examination period is evaluated by a written examination (closed book).

Calculation of the examination mark
oral exam 50%, written exam 50%