

## Active Fire Protection II: Smoke and Heat Control (E051493)

Course size (nominal values; actual values may depend on programme)  
Credits 3.0 Study time 90 h Contact hrs 60.0 h

### Course offerings and teaching methods in academic year 2018-2019

Offering	Language	Teaching Method	Hours
A (semester 1)	English	lecture	15.0 h
		seminar: coached	7.5 h
		exercises	
		project	7.5 h

### Lecturers in academic year 2018-2019

Merci, Bart TW03 lecturer-in-charge

### Offered in the following programmes in 2018-2019

Programme	crdts	offering
<a href="#">International Master of Science in Fire Safety Engineering</a>	3	A

### Teaching languages

English

### Keywords

smoke production, smoke and heat control

### Position of the course

This is a course in the International Master of Science in Fire Safety Engineering. During the hearing classes of this course, the students collect scientific knowledge regarding the chemical and physical processes of production, movement and possible control of heat and smoke in the case of fire in open and enclosed systems. Moreover, the students obtain the insight to make a scientifically based rational choice of classical and modern calculation methods and (inter)national standards at hand. The students will be able to evaluate the possibilities and limitations, depending on the situation.

### Contents

- Removal of heat in case of fire: Removal of smoke in case of fire
- Smoke movement in open air and in enclosures: Smoke plume, Hot upper layer - cold bottom layer, ceiling jet phenomenon, neutral plane
- Harmfulness of smoke: smoke properties, visibility, toxicity
- Principles of smoke control: compartmentation, smoke dilution, natural and forced ventilation, pressurisation / depressurisation
- Manual calculation methods - (inter)national standards: single storey buildings, atriums, closed car parks
- Computer calculations: zone models: theoretical background, sub models, application; application of CFD.

### Initial competences

This course builds on certain learning outcomes of the course 'Fire Dynamics'.

### Final competences

- 1 Explain the processes involved in the production of smoke in case of fire
- 2 Compute and critically evaluate the movement of smoke into and out of an enclosure
- 3 Compute and critically evaluate the removal of heat from an enclosure
- 4 Calculate an original design of smoke and heat control systems for a realistic configuration
- 5 Apply national and international standards and regulative documents for the design of smoke control systems
- 6 Perform a critical evaluation of a smoke and heat control system design

### Conditions for credit contract

This course unit cannot be taken via a credit contract

#### Conditions for exam contract

This course unit cannot be taken via an exam contract

#### Teaching methods

Lecture, project, seminar: coached exercises

#### Extra information on the teaching methods

The theory is taught by means of hearing classes.

For the exercises, the students are intensively guided during work classes.

The students must complete projects concerning calculations of SHC systems for a number of complex applications.

#### Learning materials and price

Slides (English)

Book: Bart Merci and Tarek Beji, 'Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures', CRC Press (2016). [ISBN: 978-1-138-02960-6] (+/- 80 Eur)

#### References

- B. Karlsson and J.G. Quintiere, "Enclosure Fire Dynamics", CRC Press (2000).
- J.H. Klote and J.A. Milke, "Principles of Smoke Management", Society of Fire Protection Engineers (2002).
- CIBSE Guide E, Fire Engineering, UK (1997).
- "The SFPE Handbook of Fire Protection Engineering", Fifth Edition, NFPA - SFPE (2016).
- Bart Merci and Tarek Beji, 'Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures', CRC Press (2016). [ISBN: 978-1-138-02960-6]

#### Course content-related study coaching

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 and continuous assessment

#### Examination methods in case of periodic evaluation during the first examination period

Written examination, open book examination, oral examination

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

Written examination, open book examination

#### Examination methods in case of permanent evaluation

Written examination, oral examination, report

#### Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

#### Extra information on the examination methods

Outside examination period:

SHC: each student belongs to a group and each group hands in a report of the SHC system calculations in a number of complex applications. The report is defended during an oral presentation.

During examination period:

Theory: oral open-book exam with written preparation; questions are asked on the course as well as on the report, mentioned above.

Exercises: written open-book exam.

In the second examination period now new reports can be handed. Moreover, the exam becomes completely written (open book).

#### Calculation of the examination mark

The end score (S) is calculated as:  $S = 0.25 \cdot R + 0.25 \cdot E + 0.5 \cdot T$ , with R = the score on the handed report on SHC, E = the score on the exercise exam and T = the score on the theory exam. The score T is the sum of the scores obtained for questions on the project (25%) and for other theory questions (75%).