

## Fire Dynamics (E051430)

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 2018-2019

B (semester 1)	English	practicum	7.5 h
		seminar: coached	22.5 h
		exercises	
		lecture	30.0 h

Lecturers in academic year 2018-2019

Beji, Tarek      TW03      lecturer-in-charge

Offered in the following programmes in 2018-2019

	crdts	offering
<a href="#">Bridging Programme Master of Science in Fire Safety Engineering</a>	6	B
<a href="#">International Master of Science in Fire Safety Engineering</a>	6	B
<a href="#">Master of Science in Fire Safety Engineering</a>	6	B
<a href="#">Postgraduate Studies in Fire Safety Engineering</a>	6	A

Teaching languages

English

Keywords

chemistry of fire, combustion, enclosure fire

Position of the course

This is a basic course in the Postgraduate Studies in Fire Safety Engineering. The objective is to provide detailed insight in the physics and chemistry of fires. After successful completion of the course, the student must be able to:

- analyze the fire dynamics in an enclosure,
- generate an original solution to a new complex problem of fire in an enclosure,
- perform a critical analysis of a fire.

Contents

- Scientific basic knowledge of Fire and Combustion: Fire Science and Combustion, Heat Transfer, Limits of Flammability and Premixed Flames, Diffusion Flames and Fire Plumes
- Combustion of solid and liquid fuels: Steady burning of liquids and solids, Ignition: The Initiation of Flaming Combustion, Flame Spread, Spontaneous ignition within solids and smouldering combustion
- Fire Dynamics: The Pre-Flashover Compartment Fire, The Post-Flashover Compartment Fire
- The production and movement of smoke: The production and movement of smoke.

Initial competences

Basic knowledge of fluid mechanics (properties of fluids, conservation laws for mass, total momentum and energy), thermodynamics (state values, ideal gas law) and chemistry (reactions, stoichiometry, chemical equilibrium). The ability to gather, interpret, integrate and present scientific information in a systematic manner.

Final competences

- 1 Recognise and analyse the chemical and physical processes in flames and fire.
- 2 Identify and analyse heat transfer mechanisms in a fire.
- 3 Understand and analyse smoke production and movement in case of fire.
- 4 Understand and analyse flame spread and fire growth.

- 5 Analyse fire dynamics in an enclosure for well-ventilated and underventilated conditions.

#### 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, practicum, seminar: coached exercises

#### Extra information on the teaching methods

The theory is taught as hearing classes. Exercises on fire dynamics are made by the students, guided by a teaching assistant. The students write a report, analysing data obtained from a practicum at the fire lab.

#### Learning materials and price

B. Merci and T.Beji, 'Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures', 1st Ed, CRC Press, 2016, ISBN: 978-1-138-02960-6. Price: +/- 80 Euro (CRC Press website).

#### References

- D. Drysdale, 'An Introduction to Fire Dynamics', 3rd Ed, Wiley & Sons, 2011.
- B. Merci and T.Beji, 'Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures', 1st Ed, CRC Press, 2016, ISBN: 978-1-138-02960-6.
- B. Karlsson and J.G. Quintiere, 'Enclosure Fire Dynamics', CRC Press, 2000
- J.G. Quintiere, 'Fundamentals of fire phenomena', Wiley, 2006.

#### Course content-related study coaching

Interactive support through Minerva (forums, 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 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, oral examination

#### Examination methods in case of permanent evaluation

Report

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

not applicable

#### Extra information on the examination methods

Theory: Oral exam with written preparation; in addition to general questions, also more specific questions on fire dynamics will be asked. In case of re-sit, the theory exam is written and not oral.

Exercises: written exam.

Both theory and exercises are 'open book'. Only the theory slides and the books are allowed, solved exercises are not allowed.

The written report on the practicum is assessed without oral presentation.

#### Calculation of the examination mark

The end score is calculated as follows:

- theory exam: 50% of the total score;
- exercise exam: 35% of the total score;
- practicum report: 15% of the total score.