GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2017-2018

Fluid Mechanics Applications in Fire (E051421)

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

A (semester 2)	English	group work	22.5 h
		seminar: practical PC room classes	2.5 h
		seminar: coached exercises	10.0 h
		lecture	25.0 h

Lecturers in academic year 2018-2019

De Mulder, Tom	TW15	lecturer-in-charge
Merci, Bart	TW03	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Bridging Programme Master of Science in Fire Safety Engineering	6	A
Master of Science in Fire Safety Engineering	6	A

Teaching languages

English

Keywords

Fluids, hydraulics, pipes, fire and fire fighting, fluid mechanics

Position of the course

In this course, the necessary scientific knowledge related to fluid mechanics is acquired to design a fire sprinkler installation fed by a pump sump.
Additionally, a few sessions are devoted to other applications of fluid mechanics applications, including: atomisation and liquid sprays, entrainment of air into a smoke plume and into a momentum driven jet; flows through vertical and horizontal openings; the use of PPV (positive pressure ventilation); the use of air and water curtains as means of 'compartmentation'; the interaction of water with a smoke layer. The knowledge is applied by solving case studies and by the realisation of a project. Thus, the course contributes to the core competence of the programme: master the scientific knowledge to understand, critically evaluate and analyse the fire phenomenon and its consequences.

Contents

- Characteristics of fluids
- Hydrostatics
- Hydrodynamics
- Pressurized flow through pipes, pipe networks and manifolds
- Pumps and pump sumps
- Waterhammer protection
- Fire sprinklers, atomisation and liquid sprays
- Entrainment of air into a smoke plume and into a momentum driven jet
- Flow through horizontal and vertical openings
- The use of 'Positive Pressure Ventilation' (PPV)
- The use of air and water curtains as 'compartmentation'
- The interaction of water with a smoke layer.

Initial competences

Insight in physics, construction, chemistry. Be able to search, collect, interpret, integrate and present relevant scientific and technical information.

Final competences

1 Understand pressurized flow in pipes, pipe networks and manifolds
2 Select a relevant pump and duty point for a pipe network
3 Design an original pipe netwerk with fire sprinklers, fed by means of a pump sump
4 Understand atomisation in fire sprinklers and describe the liquid spray
5 Understand the flow phenomena involved in entrainment of air into a smoke plume and into a momentum driven jet
6 Calculate flows through vertical and horizontal openings.
7 Understand the interaction of air and water with smoke.
8 Understand the background of the hydraulic aspects of an international (European) standard for design of fire sprinkler installations.

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

Group work, lecture, seminar: coached exercises, seminar: practical PC room classes

Learning materials and price

- Syllabus T. De Mulder.
- Bart Merci and Tarek Beji, ‘Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures’, CRC Press (2016). [ISBN: 978-1-138-02960-6]

References

- Bart Merci and Tarek Beji, ‘Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures’, CRC Press (2016). [ISBN: 978-1-138-02960-6]
- B.E. Larock, R.W. Jeppson and G.Z. Watters, 'Hydraulics of pipeline systems', CRC Press LLC (1999).
- J. Knauss, 'Swirling flow problems at intakes - IAHR Hydraulic structures design manual', Balkema, Rotterdam (1987).
- J.-M. Buchlin, 'Liquid sprays', Course notes, Von Karman Institute for Fluid Dynamics (1991).
- W.A. Sirignano, 'Fluid dynamics and transport of droplets and sprays', 2nd edition, Cambridge University Press (2010).
- D. Wu, D. Guillemin and A.W. Marshall, 'A modeling basis for predicting the initial sprinkler spray', Fire safety journal, 42(4), 283-294 (2007).

Course content-related study coaching

The lecturer is available for explanation and support (by appointment).

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

Oral examination, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

- The permanent evaluation during the semester is based upon a project made in small groups. The project is concerned with a fire protection study of an existing building, including the design of a sprinkler system in some parts of that building. A detailed and motivated project report needs to be compiled. Additionally, the project needs to be presented (ppt) and defended orally.
- The periodic evaluation during the exam period is based upon an individual exam, consisting of a written part (open book) and an oral part (open book). Which topics will be evaluated in the written part resp. in the oral part of the exam will be announced on Minerva prior to the examination period.

Calculation of the examination mark

Special conditions:
weight: permanent evaluation (40%) and periodic evaluation (30% written part, 30% oral part)