GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2016-2017

Advanced Fire Dynamics (E900305)

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

Credits 9.0	Study time 270 h	Contact hrs	50.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	English	lecture	20.0 h

Lecturers in academic year 2018-2019

Johansson, Nils	LUND01 lecturer-in-charge
Ingason, Haukur	LUND01 co-lecturer
Nilsson, Daniel	LUND01 co-lecturer
Svensson, Stefan	LUND01 co-lecturer
van Hees, Patrick	LUND01 co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
International Master of Science in Fire Safety Engineering	9	A

Teaching languages

English

Keywords

Compartment fires, gas temperatures, vent flows, smoke filling, fire lab

Position of the course

Contents

- Qualitative description of a fire sequence. Ignition, flame spreading. Various ways of categorising a fire. The effect of the building on the fire.
- Heat release rate. Mass burning rate and time-dependency of the heat release rate, the order of magnitude of the heat release rate, the strengths and weaknesses of various test methods, growth of alfa-t2, the effect of the enclosure on the heat release rate, extraction of power curves.
- Fire plumes and flames. Froude number, mean flame height, flame-height correlations, various profiles in a plume, ideal plumes, strong and weak plumes, plume correlations, ceiling jets, special issues to be considered in the design process, quasi-stationary conditions, selecting a plume model.
- Pressure profiles. Background on air-flow in buildings. Bernoulli's equation. Computing pressure, rate and mass air-flow through openings.
- Gas temperatures. Energy balance, rate of heat transfer, correlations for computing gas temperatures. Fully-developed fires, ISO 834, temperature calculation.
- Heat transfer. Conduction, convection, and radiation. Visibility factors, emissivity.
- Smoke filling. Pressure build-up in the fire enclosure. Transient smoke filling models. Stationary models for control of combustion gases. Various fire safety engineering systems for handling and control of combustion gases. Continuity equations.
- Combustion products. Equivalency ratios. Soot production. Visibility. How soot particles are formed. CO, CO2.
- Computer modelling. Two-zone models, sub-models for zone models. Model constraints.
- Fire lab. Enclosure fire dynamic experiment, validity and reliability of experiments.

Initial competences

Prerequisites: Mathematics, Calculus in One Variable. Recommended qualifications: Thermodynamics and Fluid Mechanics, Basic Course.

Final competences

The overriding aim of the course is that, after taking the course, the students will understand the various stages that a fire in a building goes through. Furthermore, the course is aimed at providing the students with a knowledge base concerning the different methods and techniques applied in the analysis of a fire sequence, as well as developing their ability to critically examine those methods in terms of practical application. The course is also aimed at increasing the engineering-related ability to construct and analyse models.

Knowledge and understanding

For a passing grade the student must:

- be able to explain the effect of the enclosure on a fire sequence.
- be able to explain the range of application of the models and the applicable constraints for fire safety engineering computations.
- be able to characterise the various stages of a fire sequence based on various variables.

Skills and abilities

For a passing grade the student must:

- be able to apply various manual computation models and computer models (2-zone models) for calculating various variables in a compartment fire.
- be able to calculate the value of various physical variables associated with a fire sequence.
- be able to analyse and interpret results from fire safety engineering experiments.
- be able to judge the reasonableness of calculated results obtained from various computational models.
- be able to estimate data values for input into computational models where these are lacking in the problem statement.
- be able to design fire safety engineering systems for control and handling of combustion gases.
- be able to evaluate the effect the fire event can have on people occupying the building.
- be able to calculate the time before critical conditions are reached for fires in a building.
- be able to defend, orally and in writing, his/her choice of models and assumptions in the analysis of fire sequences.
- be able to present results from fire safety engineering experiments in a clear and scientific manner.
- be able to search for and apply information concerning fire evolution inside buildings in scientific journals and manuals.
- be able to plan and carry out fire safety engineering experiments.

Judgement and approach

For a passing grade the student must:

- demonstrate a capacity to make judgements on the applicability of various computation models to various types of problems.
- demonstrate insight into the responsibilities of a fire engineer in choosing and reporting parameters in such a way that the models are used properly.

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

Group work, lecture, seminar, self-reliant study activities, seminar: coached exercises

Extra information on the teaching methods

The course and the lectures follow the chapters in the book Enclosure Fire Dynamics. The problems given in the end of each chapter in the book are solved individually on scheduled exercises and outside class.

Learning materials and price

Karlsson, B., Quintiere, J G: Enclosure Fire Dynamics. CRC Press, 1999. ISBN: 0-8493-1300-7
Supplement papers

References

Karlsson, B., Quintiere, J G: Enclosure Fire Dynamics. CRC Press, 1999. ISBN: 0-8493-1300-7

Course content-related study coaching

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, assignment

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

Written examination, open book examination, assignment

Examination methods in case of permanent evaluation

Assignment, skills test

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

The final certificate is based on a written examination (individual work), home assignments (individual work), and laboratory work reports (group work), and requires participation in compulsory seminars.

Calculation of the examination mark

Grades are based on exam results and extra points from the three assignments (max 1 point per assignment) and one lab report (between 0 and 3 points).