

## Structural Design for Fire (E900522)

**Course size** (nominal values; actual values may depend on programme)  
**Credits** 6.0      **Study time** 180 h      **Contact hrs** 22.0 h

### Course offerings in academic year 2017-2018

A (semester 1)

### Lecturers in academic year 2017-2018

Law, Angus

EDINBU lecturer-in-charge

Bisby, Luke

EDINBU co-lecturer

### Offered in the following programmes in 2017-2018

[International Master of Science in Fire Safety Engineering](#)

crdts	offering
6	A

### Teaching languages

English

### Keywords

Fire Safety Engineering, Structural fire engineering, fire dynamic, structural mechanics, steel, concrete

### Position of the course

The course will provide a brief overview of the fundamentals of fire behaviour in buildings and introduce simple methods of quantifying the threat it poses to structures. This will involve estimating the temperatures in building compartments and the temperatures that individual structural members get exposed to as a function of time. Fundamentals of the behaviour of common construction materials and estimation of the variation of mechanical properties of construction materials affected by fire (i.e. temperature rise). Structural analysis principles are then applied to the fire problem. Simple methods to carryout calculations to determine structural behaviour in the event of a fire will be presented followed by an introduction to advanced analytical and computational tools for analysing structural behaviour in fire. Finally an introduction to current (code based) design procedures and performance based design will be provided and a design project will be assigned.

### Contents

1. Introduction
2. Fire Safety in Buildings
3. Fire and Heat
4. Room Fires
5. Fire Severity
6. Fire Resistance
7. Design of Structures Exposed to Fires
8. Steel Structures in Fire
9. Concrete Structures in Fire
10. Timber Structures in Fire
11. Playing with Fire
12. Advanced Analysis

### Initial competences

None are assumed.

### Final competences

- 1 Understanding the philosophical and statistical underpinnings of structural design at both ambient and elevated temperature conditions;
- 2 Survey the different analytical and empirical tools for fire calculations in both small and open plan compartments;

- 3 Describe the effect of temperature on material properties of - Steel, concrete, wood, composites; fire proofing and thermal insulation;
- 4 Understanding heat transfer calculations based on standard fires - ISO 834, Parametric Temperature vs. Time Curves; Real Fires (Temperature vs. Heat Flux);
- 5 Understand the role of loss of strength, deformation and thermal expansion and application to design of structures for fire resistance - Includes advanced analytical principles and calculations, and structural design for fire.

#### **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, seminar

#### **Extra information on the teaching methods**

22 hours of lectures; 1 hour of formative assessment; 2 hours of summative assessment; 2 hours of programme level learning and teaching; 93 hours of directed and independent learning.

Feedback will be available throughout the course by discussion with tutors and lecture staff.

Tutorials will also offer a route for formal, formative feedback.

Students will be given the opportunity to provide Stop, Start and Continue feedback and comments on this will be provided back by the course lecturer.

Exam Post-Mortem comments will be provided.

#### **Learning materials and price**

- 1 Buchanan, A.H. (2001) Structural Design for Fire Safety. Wiley.
- 2 CEN (200#) BS EN 1991-1-2 - Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire
- 3 CEN (2004) BS EN 1992-1-2 - Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design.
- 4 CEN (2005) BS EN 1993-1-2 - Eurocode 3: Design of steel structures - Part 1-2: General rules - Structural fire design.
- 5 CEN (2004) BE EN 1995-1-2 - Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design.

#### **References**

#### **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

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

#### **Examination methods in case of permanent evaluation**

Assignment, skills test

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

not applicable

#### **Extra information on the examination methods**

The assessment will be made on the basis of:

Intermittent Assessment 20%

Eight tutorials

Written Examination (80%)

The written examination will be 2 hours long with 3 compulsory questions.

#### **Calculation of the examination mark**

Written Exam 80 %, Coursework 20 %