

## Fire Resistance of Steel and Timber Structures

**Subject area:** Civil Engineering/Architecture

<b>University:</b>	CTU
<b>Level:</b>	BA3, BA4, MA all years
<b>Teaching mode:</b>	hybrid: some students participate online, other students attend real-life
<b>Instructor(s):</b>	Prof. František Wald, Dr. Lukáš Velebil, Ing. Michal Šejna

### Short description

The aim of this course is to give students an understanding of the design methods of structures at accidental situations. It is focused on design methods involved in fire design: prediction of fire scenario, evaluation of fire load, calculation of gas temperatures in the fire compartment and structural analysis at elevated temperature. Special attention is paid to fire modelling when several design models is presented including nominal temperature curves, simple models and advanced models.

### Full description

- 1 Introduction to fire safety
  - 1.1 - Fire safety, classification of structures, fire compartments, escape routes (general overview)
  - 1.2 - Natural fire and its relation to design to fire safety
- 2 Fire load and models of fire
  - 2.1 - Fire load density, characteristic and design load, effect of active fire measures, rate of heat release, fire scenarios
  - 2.2 - Simple models for compartment fires, nominal fire curves, parametric temperature curve  
Practical calculation of fire load density for simple compartment, evaluation of temperature curve, comparison of different models, advantages and disadvantages of simple models
  - 2.3 - Advanced fire for compartment fires, zone models, CFD models  
Application of software to apply zone models for thermal analysis, overview of CFD analysis
  - 2.4 - Fire load for localised fires, modelling of localised fires
  - 2.5 - Accidental load combination, structural analysis at fire
- 3 Transfer of heat to steel structures
  - 3.1 - Temperature of unprotected steel elements at fire, fire protection of steel structures, temperature of protected steel elements at fire
  - 3.2 - Video from large scale fire test in Cardington, example of analysis of steel structure in Cardington
- 4 Fire resistance of steel structures
  - 4.1 - Material properties of steel at high temperatures
  - 4.2 Fire resistance of steel elements Models
  - 4.3 - Design of joints

- 5 Fire resistance of steel and concrete composite structures
  - 5.1 - Fire resistance of composite slab
  - 5.2 - Resistance of composite beams
  - 5.3 - Resistance of composite columns
- 6 Fire resistance of timber structures
  - 6.1 - Behaviour of timber structures exposed to fire, fire protection of timber structures
  - 6.2 - Design method for timber structures
- 7 Fire resistance of timber elements
  - 7.1 Method of effective cross-section, method of reduced stiffness and strength
  - 7.2 Design of joints
- 8 Advanced models in fire engineering
  - 8.1. Modelling of fire, transfer of heat and mechanical behaviour
  - 8.2 Floor behaviour
  - 8.3 Robustness of structures

## Learning outcomes

This course brings students an understanding of the design methods of structures at accidental situations. It is focused on design methods involved in fire design: prediction of fire scenario, evaluation of fire load, calculation of gas temperatures in the fire compartment and structural analysis at elevated temperature.

## Recommended in particular for students of the following study programmes

Civil Engineering and Architecture

## General information

- Contact hours per week:** 2
- Total workload:** 50 (in student hours for the whole course)
- ECTS credits:** 2
- Language:** English
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- Course start date:** 20 February 2023
- Course end date:** 28 May 2023
- Add. info about start date:** Start course date refers to start of the semester at CTU. Schedules will be available 1-2 weeks before semester starts.
- Weekly teaching day/time:**
- Time zone:** CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)
- Further information:** Lessons will be recorded and provided to students.

<b>Prerequisites:</b>	Bases of structural mechanics and building engineering
<b>Activities and methods:</b>	Lectures, Seminars
<b>Presence on campus:</b>	No required.

### Final examination

<b>Form:</b>	written and oral examination
<b>Date:</b>	
<b>Location/format:</b>	online
<b>Re-sit possibility:</b>	yes
<b>Transcript available:</b>	end of semester
<b>Add. info/requirements:</b>	

### Registration

To register for this course, follow the registration requirements of your **home university** as specified here: [www.euroteq.eu/courses-registration](http://www.euroteq.eu/courses-registration).

### Administration

<b>Number of places:</b>	20
<b>Minimum participants:</b>	6
<b>Internal course code:</b>	134FSTS
<b>Contact:</b>	wald@fsv.cvut.cz

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