

# Course description

<b>Course abbreviation:</b>	KME/OC	<b>Page:</b>	1 / 4
<b>Course name:</b>	Steel Structures		
<b>Academic Year:</b>	2023/2024	<b>Printed:</b>	03.06.2024 08:13

<b>Department/Unit /</b>	KME / OC			<b>Academic Year</b>	2023/2024
<b>Title</b>	Steel Structures			<b>Type of completion</b>	Exam
<b>Accredited/Credits</b>	Yes, 5 Cred.			<b>Type of completion</b>	Combined
<b>Number of hours</b>	Lecture 3 [Hours/Week] Tutorial 2 [Hours/Week]			<b>Course credit prior to</b>	YES
<b>Occ/max</b>	Status A	Status B	Status C	<b>Counted into average</b>	YES
<b>Summer semester</b>	0 / -	0 / -	0 / -	<b>Min. (B+C) students</b>	10
<b>Winter semester</b>	0 / -	0 / -	0 / -	<b>Repeated registration</b>	NO
<b>Timetable</b>	Yes			<b>Semester taught</b>	Winter semester
<b>Language of instruction</b>	Czech			<b>Internship duration</b>	0
<b>Optional course</b>	Yes			<b>Ev. sc. – cred.</b>	S N
<b>Evaluation scale</b>	1 2 3 4				
<b>No. of hours of on-premise</b>					
<b>Auto acc. of credit</b>	Yes in the case of a previous evaluation 4 nebo nic.				
<b>Periodicity</b>	K				
<b>Substituted course</b>	None				
<b>Preclusive courses</b>	N/A				
<b>Prerequisite courses</b>	N/A				
<b>Informally recommended courses</b>	KME/ZTM1				
<b>Courses depending on this Course</b>	and KME/PPS1 and KME/ST1 N/A				

## Course objectives:

The student

- will understand the design of steel and steel-concrete structures and the basic principles
- will be informed about the valid standards for the different materials and structures and for the calculation of loads
- will understand the design of steel structures and steel-concrete structures in accordance with the standard ČSN EN 1993
- will understand the ultimate limit state and the serviceability limit state

## Requirements on student

Requirements for credit:

The student will elaborate and hand in a semestral project of an adequate level. Preparation of seminars crash of steel structures, steel structures model development.

Credits from the subject KME/OC obtained in previous studies are not acknowledged

Requirements for exam:

Active knowledge of the content of the course, ability to apply the knowledge to solve practical exercises.

## Content

1st week: Process for the design of structures, designed lifetime, design situation, principles for design with regard to reliability, resistance of the structure, ultimate limit state and serviceability limit state, materials for steel structures, corrosion. Production of steel structures.

2nd week: Designing steel elements with regard to the standard ČSN EN 1993, classification of sections. Tension, compression,

stability of the ideal beam, local stability, effective length.

3rd week: Definition for planar buckling, effective length for torsion, effective lengths for the different members, systems of members and frames. Second order theory, buckling resistance, bearing capacity of compressed members, articulated members.

4th week: Bending, bearing capacity during bending, bi-axial bending, stability in bending, economic design, deflection and oscillation of members, buckling of walls and local loads.

5th week: Combination of tension and bending, compression and bending, bending and torsion.

6th week: Joints, welded joints, screw joints, bolted joints, rivet joints, distribution of forces in the connection points.

7th week: Steel-concrete structures as defined by the standard ČSN EN 1994. Materials, interaction between the materials, bonding elements, principles for design.

8th week: Limit states for the design, beams, classification of sections, bearing capacity of the section, stability, shear connection, structural details. Centric compression, bending, compression and bending, serviceability limit state, metallic-concrete slabs.

9th week: Thin cold-rolled structures, material, production, reinforcing the material, local buckling, main types of solicitation, tension, compression, bending, shear, combination of effects, joints, thin elements.

10th week: Corrosion of steel structures, production of steel structures, documents of the supplier. Typical steel structures ? halls and their design.

11th week: Calculation of fire resistance of steel and steel-concrete structures, mechanical loads during fire, principles for design.

12th week: Transmission of heat in the structure, analysis of elements and joints.

13th week: Single cases for steel elements during fire ? beam, beam with loss of stability, column of a tall building, connection between the beam and the column.

## Fields of study

## Guarantors and lecturers

- **Guarantors:** Ing. Petr Kestl, Ph.D. (100%)

## Literature

- **Basic:** Studnička J. *Ocelové a ocelo-betonové konstrukce*. ČKAIT TK9 Praha, 2000.
- **Recommended:** ČSN EN 1990 - *Základy navrhování*.
- **Recommended:** ČSN EN 1991 - *Zatížení stavebních konstrukcí*.
- **Recommended:** ČSN EN 1993 - *Navrhování ocelových konstrukcí*.
- **Recommended:** ČSN EN 1994 - *Navrhování ocelo - betonových konstrukcí*.
- **Recommended:** Wald Fr. a kolektiv. *Výpočet požární odolnosti stavebních konstrukcí*. ČVUT Praha, 2005.

## Time requirements

### All forms of study

Activities	Time requirements for activity [h]
Contact hours	65
Preparation for an examination (30-60)	40
Undergraduate study programme term essay (20-40)	40

Total:

145

**assessment methods****Knowledge - knowledge achieved by taking this course are verified by the following means:**

Oral exam  
Seminar work

**Skills - skills achieved by taking this course are verified by the following means:**

Oral exam  
Seminar work

**Competences - competence achieved by taking this course are verified by the following means:**

Seminar work

**prerequisite****Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:**

characterize and get acquainted with the mechanics of the continuum  
characterize and get acquainted with the technical science of elasticity and strength  
characterize and get acquainted with the mathematical theory of elasticity  
characterize and get acquainted with the stability of bars  
characterize and get acquainted with the theory of plasticity  
characterize and get acquainted with the theory of failure

**Skills - students are expected to possess the following skills before the course commences to finish it successfully:**

classify and solve complex cases of elasticity and strength  
classify and solve variational methods  
classify and solve shells  
classify and solve the nonlinear theory of elasticity  
classify and solve the state of plasticity under general stresses  
classify and address safety assessments according to internal force limits

**Competences - students are expected to possess the following competences before the course commences to finish it successfully:**

N/A  
N/A  
N/A  
N/A  
N/A

**teaching methods****Knowledge - the following training methods are used to achieve the required knowledge:**

Lecture  
Practicum

**Skills - the following training methods are used to achieve the required skills:**

Lecture  
Practicum

**Competences - the following training methods are used to achieve the required competences:**

Lecture

## Practicum

## learning outcomes

**Knowledge - knowledge resulting from the course:**

- describe forming, heat treatment and properties of steels
- describe production methods, metallurgical materials and assortment of rolled products
- explain methods for solving welded, screw and riveted joints
- state the procedures of analysis of drawn, pressed and bent structural elements, as well as combined stressed
- describe the fatigue process and design principles with respect to fatigue phenomena
- state the principles of designing thin-walled structures
- describe light alloy constructions

**Skills - skills resulting from the course:**

- systematize the tolerances of the rolled material
- to solve combinations of stresses acting on frame structures
- apply elastic and plastic torsion theory to steel structural elements
- determine experimentally the residual life of structures
- to solve the tasks of the economy of corrosion protection

**Competences - competences resulting from the course:**

N/A

N/A

N/A

**Course is included in study programmes:**

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Civil Engineering	Bachelor	Full-time	Building Structures	1	2022	2023	Povinné předměty	A	3	ZS
Civil Engineering	Bachelor	Full-time	Building Structures	1	2023	2023	Povinné předměty	A	3	ZS
Civil Engineering	Bachelor	Full-time	Building Structures	1	2018	2023	Povinné předměty	A	3	ZS