

Course Specifications

From the academic year 2017-2018 up to and including the

Metal Structures (E044510)

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

Credits	6.0	Study time	180 h	Contact hrs	60.0 h
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Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch, English	lecture	30.0 h
		seminar: coached	30.0 h
		exercises	

Lecturers in academic year 2018-2019

Van Tittelboom, Kim	TW14	lecturer-in-charge
De Waele, Wim	TW08	co-lecturer

Offered in the following programmes in 2018-2019

Bachelor of Science in Civil Engineering	crdts	offering
	6	A

Teaching languages

Dutch, English

Keywords

Steel structures, metal joints, welding, soldering, adhesive bonding, corrosion, sustainability, structural steelwork analysis, plastic analysis, yield criterion, classification of sections, strength of sections, steel beams, connection design, Eurocode 3

Position of the course

In the first section of the course the students are getting insight in different joining techniques for metals. The main focus is on welding, but adhesive bonding and mechanical joining techniques are also discussed. Besides the physical principles, the technological aspects of the different joining techniques are studied as well as the practical implications on the design of the joint. The aim of the second section of the course, "Structural steelwork analysis", is to teach the students how to design a simple steel construction according to the principles of elasticity and plasticity. They are aware of the fact that such a design is closely related to the classification of cross-sections, in agreement with the current design philosophy of the structural eurocodes. The students are also able to analyse and to design welded and bolted connections.

Contents

- Joining Technology in steel structures:
 - Welding: general principles, advantages and disadvantages, quality control, structural aspects, weldability and defects
 - Fusion welding, solid-state pressure welding, fusion pressure welding, laser welding, soldering, cutting, gouging
 - Adhesive bonding: principles, types of adhesives, advantages and disadvantages, load transfer and structural design, evaluation and testing
 - Mechanical fasteners: technology of joints based on (pretensioned) bolts
- Calculation of steel structures: Principles of the calculations of steel structures, Welded joints, Prestressed bolted joints, Connections with fitting bolts and rivet studs, Solid-webbed beams, Available hot and cold rolled profiles, Application of the yield criterion: tube under internal pressure, Strength condition in a section, Case studies of welded joints, Case studies of bolted joints, Solid-webbed beams: dimensioning of profiled beams

Initial competences

Mechanics of materials, Structural analysis I

Final competences

- 1 To be able to dictate the conditions for a good execution of welds

- 2 To be able to design and to calculate connections with welds or bolts
- 3 To be able to design an ordinary steel construction so that the strength conditions in the cross sections are fulfilled (the verification of the local or the global stability of the structure is taught in the course "Berekening van Bouwkundige Constructies III").
- 4 Understand the physical principles of joining techniques
- 5 Describe the technological aspects of joining techniques
- 6 Critically compare different joining techniques
- 7 Understand terminology specific to joining techniques

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

Lecture, seminar: coached exercises

Extra information on the teaching methods

- Theory on welding, adhesive bonding and laser applications: lectures by Prof. W. De Waele in English.
- Theory on the calculation of steel structures: lectures by Prof. K. Van Tittelboom in Dutch.
- Exercises: guided exercises in Dutch.

Learning materials and price

Course material (handbook, slides, movies) of partim 'technology of joining' available on Minerva.

Course notes of partim 'calculation of steel structures' available at VTK.

References

- Welding processe handbook, 2nd Edition, Ed. K. Weman, Woodhead Publishing, ISBN 978-0-85709-518-3, 2012
- D. Vandepitte "Berekening van Constructies" Deel II-1980 Wetenschappelijke uitgeverij E. Story - Scientia

Course content-related study coaching

The docents are available before and after the courses.

Evaluation methods

end-of-term evaluation

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

Written examination, open book examination

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

Written examination, open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

During examination period: theory: written closed-book examination;
Calculations: written open-book examination.

Calculation of the examination mark

Special conditions: Theory (welded joints, adhesive bonding and laser applications, taught by W. De Waele): 40% (written exam closed book)

Theory (calculation of steel structures, taught by K. Van Tittelboom): 15% (written exam closed book)

Exercises (calculation of steel structures, taught by K. Van Tittelboom): 45% (written exam open book)

In case one obtains a score of 9/20 or less on one or more of the above mentioned parts, the student will not pass for the entire course. The final score is then the minimum of 9/20 and the above mentioned weighted result.