GHENT UNIVERSITY

Course Specifications

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

Structural Analysis II (E044220)

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

Credits	6.0	Study time	180 h
Contact hrs	60.0 h		

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	Dutch	lecture	30.0 h
		seminar: coached exercises	10.0 h
		seminar: practical PC room classes	20.0 h

Lecturers in academic year 2018-2019

Van Tittelboom, Kim	TW14	lecturer-in-charge
Steenbergen, Raphaël	TW14	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Bachelor of Science in Civil Engineering	6	A
Master of Science in Engineering: Architecture (main subject Architectural Design and Construction Techniques)	6	A
Master of Science in Engineering: Architecture (main subject Urban Design and Architecture)	6	A
Preparatory Course Master of Science in Civil Engineering	6	A

Teaching languages

Dutch

Keywords

The Displacement Method, wind load, lateral stability, bracings, stiff core, plates, FEM, pre- and postprocessing, peak moments

Position of the course

‘Structural Analysis I’ is one of the basic disciplines in the education programme Bachelor in Civil Engineering and is taught in the first semester of the third year (MT1). This course forms the basis for more advanced courses such as ‘Bridges I’, ‘Bridges II’, Structural Analysis III’, ‘FEM and Constitutive Material Laws in Structural Engineering’, the ‘Cross-Course Project’ and ‘Design of Civil Structures’.
The aims are to (i) to assess the influence of wind effects on structures using the international design guidelines; (ii) to indicate the importance of the lateral stiffness of structures in relation to (i) and the calculation of structural bracings with respect to obtaining sufficient stiffness and stability; (iii) to teach the basics of the displacement method for bars in frame and truss systems as these form the basis for more advanced numerical techniques; (iv) to teach the basics of plate theory; (v) to teach the basic aspects of commercial FEM software for the structural analysis of systems composed of bar and plate elements; (vi) to learn how to evaluate the results of such software programs in a critical way.

Contents

- Wind loads: statistical description and characteristic wind load, wind load on stiff structures, wind load on flexible structures, applications
- Lateral stiffness of a structure: wind and stability bracing, concept and design, brace design for an industrial hall, force transfer towards a central shaft in a building
- Displacement method: general calculation and stiffness equations for a trellis element, trellis element from beam grid, from 2D or 3D lattice work, set of trellis elements, boundary conditions and effect of prescribed node displacements, extension to rod vibrations, computer modelling and analysis of complex structures
- Plates subjected to bending: basic equations of Kirchoff, boundary conditions, linear

elastic thin plates subjected to small deformations, axi-symmetric plate problems, rectangular plates
- Introduction FEM analyses: elements and degrees of freedom, implementation of the element method, pre- and postprocessing
- Analysis of FEM results based on examples: critical evaluation of stresses, dealing with singularities, problems related to averaging of results in nodes, treatment of peak moments

Initial competences

Structural Analysis I

Final competences

1 Modelling and calculation of structural elements composed of bar and plate elements using the displacement method.
2 Critical analysis of calculation results and the presentation of these results both individually as in a team.
3 Being able to calculate the influence of wind loads on rigid and flexible structures.
4 Conceptual design and dimensioning of wind and stability bracings with respect to the lateral stability of structures.
5 Develop an engineering attitude for the simplified modeling of real structures composed of bars and plates and being able to solve these.
6 Being able to apply commercially available FEM software for the analysis of structures composed of bar and plate elements for the analysis of simple, but realistic design situations.
7 Being able to perform a critical evaluation of the results obtained from commercially available FEM software for the analysis of structures composed of bar and plate elements.

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, seminar: practical PC room classes

Learning materials and price

Syllabus

References

- D. Vandepitte : "Berekening van Constructies - Bouwkunde en Civiele Techniek", Wetenschappelijke uitgeverij E.Story-Scientia, Gent, 1982.
- Belgisch instituut voor normalisatie , "NBN EN 1991-1, Eurocode 1", Brussel 1991
- J. Blaauwendraad: “Plates and FEM: Surprises and Pitfalls”, Springer, Dordrecht, 2010
- P. Marti: “Theory of Structures”, Ernst & Sohn, Berlijn, 2013.

Course content-related study coaching

The lecturer and assistants can be contacted before or after the lectures or exercise sessions, through e-mail or after making an appointment.

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

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

Written examination, open book examination

Examination methods in case of permanent evaluation

Oral examination, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

- End-of-term evaluation: written exam with closed book (theory) and written exam with open book (exercises).

- Continuous assessment: evaluation of project reports.

Calculation of the examination mark

In order to obtain the final marks the following weighing factors are used:

- exam related to the theory: 3/9
- exam related to the exercises: 2/9
- project report and oral defense: 4/9