GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Structural Analysis I (E044120)

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 2)	English	guided self-study	30.0 h
		seminar: coached exercises	30.0 h
B (semester 2)	Dutch	seminar: coached exercises	30.0 h
		lecture	30.0 h
C (semester 2)		lecture	15.0 h
		seminar: coached exercises	15.0 h

Lecturers in academic year 2018-2019

Caspeele, Robby	TW14	lecturer-in-charge
Van Tittelboom, Kim	TW14	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Bachelor of Science in Civil Engineering	6	B
Bridging Programme Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	A
Bridging Programme Master of Science in Civil Engineering	3	C
Bridging Programme Master of Science in Civil Engineering	3	C
Switching Track to Engineering	3	C
Master of Science in Engineering: Architecture (main subject Architectural Design and Construction Techniques)	3	C
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	A
Master of Science in Engineering: Architecture (main subject Urban Design and Architecture)	3	C
Preparatory Course Master of Science in Civil Engineering	3	C

Teaching languages

Dutch, English

Keywords

Structural analysis, equilibrium, influence line, actions, limit states, eurocodes, strength, stiffness, bending, torsion, shear, beams, frames, trusses, arches, arch-like constructions

Position of the course

The determination of reactions, internal forces in and deformations and displacements of a civil engineering construction under loadings. A profound and detailed knowledge of the mechanical behaviour of structural elements and structures is a neccesary precursor in order to understand structural thinking of the creative designer and to make adequate decisions with respect to the much broader, complex design proces. That is the reason why the structural behaviour of a number of important load-bearing systems under given loads is discussed first. Accents are placed on calculation methods of structural engineering by which the structural behaviour is explained, on loads and load arrangements, on structural elements and their interacting role.

Contents

1 Load bearing systems and loads: Elements, entities, aggregates and hierarchies, Loads, Load determination in simple structures;
2 General strength and stiffness requirements: The structural Eurocodes and limit states methods, Load combinations;
3 Equilibrium of a deformable structure and its components: Study of forces in a structure, Virtual work, Mohr's, Greene's and Betti-Maxwell's theorems, Bending moments, shear and normal forces in isostatic beams, M, N, V in isostatic frames, Determination of linear displacement and rotations, M, N, V in simple hyperstatic systems;
4 Particular aspects of beam theory: Composed and oblique bending and associated stress distributions, Effects of shear force and shear centre, Pure torsion of simple and multiple connected sections, Principles of elastic instability: Euler's pressure rod, Stresses in an arbitrary section by M and N, Shear stress calculations by shear force, Shear centre and torsion of a C-shaped profile, Torsion of a box girder;
5 Influence lines: Statically determinate stresses and displacements, Hyperstatic quantities, Influence line for N,M,V in isostatic frame, Influence line for elastic displacement and hyperstatic quantity, Estimation of a design value;
6 Gehler's method: Frames, Hyperstatic beams and beams on elastic support, Refinement of the method, Stresses in hyperstatic frames, Continuous beam: rigid vs. elastic support, Neglection of shear effect and node dimensions in practice;
7 Trusses: Composition and principle, Types, Example: forces and displacements for a Neuville girder
8 Arches and arch structures: Bresse's equations and funicular arches, Types, Stresses in arches, Stress calculation for arch structures.

The course of 3 credits only covers the topics 3,4(partim),6(partim),7,8 as explained above and relates to the end competences 1,4,5,8,9,10.

Initial competences

This course builds on certain learning outcomes of following course units: Physics I; Mechanics of materials or Mechanics,

Final competences

1 Knowing and being able to use basic terminology with regard to structural analysis
2 Understanding which types of structural systems exist and which types of load can work on a structure.
3 Having insight in the design philosophy of the eurocodes with regard to limit states and being able to apply this.
4 Understanding the principle of virtual work and using this to determine the deformation of structural elements and to express compatibility conditions, e.g. on the basis of the integrals and analogies of Mohr and the theorems of Greene.
5 Understanding the effects of bending moments, normal force, shear force and St Venant Torsion on the normal and shear stresses in a cross-section and be able to determine these.
6 Determining the flexural critical buckling load of compressed members by means of appropriate differential equations and boundary conditions.
7 Determining the influence lines of stress resultants and deformations in a direct and indirect manner.
8 Understanding and applying the slope-deflection method for frames and continuous beams with rigid or spring supports.
9 Determining the load distribution and displacements in statically determinate and indeterminate trusses. Determining influence lines for trusses.
10 Knowing and using the principle of funicular arches. Deriving and applying Bresses's equations for different arch types and be able to determine influence lines for these 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

Guided self-study, lecture, seminar: coached exercises

Learning materials and price

course notes (about 15 euro).

References

- D. Vandepitte : "Berekening van Constructies - Bouwkunde en Civiele Techniek", Wetenschappelijke uitgeverij E.Story-Scientia, Gent, 1982.
- Belgisch instituut voor normalisatie , "NBN ENV 1991-1, Eurocode 1", Brussel 1991

Course content-related study coaching

befor or after class, by email or during 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 with open questions, written examination

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

Written examination with open questions, written examination

Examination methods in case of permanent evaluation

Written examination, open book examination

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

- Continuous assessment: exercises (open book, date and contents announced at start of semester)
- Periodic evaluation during examination period: written exam with closed book (theory), written exam with open book (exercises)

Calculation of the examination mark

Special conditions: the exam on theory has a weighting factor of 1/3 and the exam on the exercises has a weighting factor of 4/9; the evaluation during semester has a weighting factor of 2/9.