GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2026-2027

Structural Stability (E044311)

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

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2026-2027

A (semester 1)	English	Gent	seminar	
			lecture	
B (semester 1)	Dutch	Gent	seminar	0.0h
			independent work	0.0h
C (semester 1)	English	Gent	lecture	0.0h
			seminar	0.0h
D (semester 1)	Dutch	Gent	independent work	0.0h
			seminar	0.0h

Lecturers in academic year 2026-2027

Caspeele, Robby	TW14	lecturer-in-charge

Offered in the following programmes in 2026-2027	**crdts**	**offering**
Bridging Programme Master of Science in Civil Engineering	6	A
Bridging Programme Master of Science in Engineering: Ships and Marine Technology	3	C
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	3	D
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	A
International Master of Science in Advanced Design of Sustainable Ships and Offshore Structures	3	C
Master of Science in Civil Engineering	6	B
Master of Science in Civil Engineering	6	A
Master of Science in Engineering: Ships and Marine Technology	3	D
Master of Science in Engineering: Ships and Marine Technology	3	C

Teaching languages

English, Dutch

Keywords

Critical load, post critical behaviour, buckling modes, flexural buckling, plate buckling, lateral torsional buckling, overturning of lifted beams, compression members

Position of the course

In the course "Metal Constructions," you will learn how to dimension the components of a steel structure (such as solid beams and connections) in such a way that the strength requirements at critical sections and points are met, in addition to stiffness requirements. This course also highlights additional aspects that play a role in dimensioning. It is not only important to examine the strength of critical sections and connections but also the stability of the components of the supporting system, such as buckling of compression members, bending of plates, and lateral-torsional buckling of beams. Geometrically non-linear calculations are also discussed. In these calculations, equilibrium relationships are established while taking into account initial assembly errors and deformations. This non-linear calculation also considers the effective stiffness of members subjected to axial forces.

In the reduced version of this course (3 credits) only a part of the afore mentioned topics are treated (see 'content').

Contents

Content for the version of 6 credits:

- Potential energy: Conservative system of forces and elastic energy
- Principle of minimum potential energy: Determination of an equilibrium state, Method of Ritz
- Nature of the equilibrium state: Stable, unstable and indifferent equilibrium: Simple mechanical models, Post critical behaviour of a compression member, Beam on elastic foundation and cylinder, Plates, Failure modes of a frame, Influence of geometrical imperfections
- Second order effects in frames: P-Delta effect, Stability functions, Implications in the method of Gehler
- Compression members: Flexural buckling, Uniform built-up compression members, Members with bending and axial compression
- Lateral torsional buckling of plate girders
- Folding of plate girders and thin-walled box girders

Content for the version of 3 credits:

- Potential energy: Conservative system of forces and elastic energy
- Principle of minimum potential energy: Determination of an equilibrium state, Method of Ritz
- Nature of the equilibrium state: Stable, unstable and indifferent equilibrium: Simple mechanical models, Post critical behaviour of a compression member, Beam on elastic foundation and cylinder, Plates, Influence of geometrical imperfections
- Compression members: Uniform built-up compression members
- Lateral torsional buckling of plate girders
- Folding of plate girders and thin-walled box girders

Overview chapters:

1 About the nature of the elastic equilibrium and the postcritical behaviour
2 Warping torsion
3 Spatial equilibrium, in the deformed state, of beams of arbitrary open cross section
4 Axial-torsional buckling and flexural-torsional buckling of compression members
5 Lateral-torsional bucking of plate girders subjected to bending
6 Eccentrically loaded prismatic compression members
7 Uniform built-up compression members
8 Buckling and stiffening of webs of plate girders or flanges of thin-walled box girders
9 Geometrical nonlinear behaviour of frames

The course of 3 credits only covers the chapters 1, 5, 7 and 8.

Initial competences

This course builds on certain learning outcomes of the following course units: Mechanics of Materials and either Structural Analysis I and II and Metal Constructions (Civil Engineering) or Mechanics of Structures (Electromechanical Engineering)

Final competences

1 To understand and to be able to apply the theory of non linear behaviour of structures.
2 To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable).
3 Being able to solve basic instability problems.
4 Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression (only for the version of 6 credits).
5 Being able to calculate the resistance of a structural element subjected to lateral torsional buckling, folding (only for the partim version of 3 credits).
6 Being able to design a twofold compression member.
7 To be able to design and to calculate a frame taking into account geometrically non linear behaviour (only for the version of 6 credits).
8 To understand the effect of imperfections on the behaviour of structures.

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

Seminar, Lecture, Independent work

Study material

Type: Syllabus

Name: Structural Stability
Indicative price: € 20
Optional: no
Language : English
Available on Ufora : No
Online Available : No
Available through Student Association : Yes

Type: Slides

Name: Slides lectures
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available on Ufora : Yes

Type: Handouts

Name: Supporting material exercise lectures
Indicative price: Free or paid by faculty
Optional: no
Available on Ufora : Yes

References

- D. Vandepitte, Berekening van Constructies, (Deel I -1979, II-1980 en III-1981) , Story-Scientia Gent.
- www.berekeningvanconstructies.be

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.

Assessment moments

end-of-term and continuous assessment

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

Oral assessment, Written assessment open-book

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

Oral assessment, Written assessment open-book

Examination methods in case of permanent assessment

Oral assessment, Written assessment open-book

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

During examination period: oral closed-book examination (theory); written open-book examination (exercises). During semester: 1 or more evaluation sessions with written exercises to be solved open-book or the oral presentation of the analysis of a scientific journal article.

Calculation of the examination mark

Special conditions: the end-of-term exam on theory has a weighting factor of 1/3 and the end-of-term exam on the exercises has a weighting factor of 4/9; the permanent assessment has a weigthing factor of 2/9.