GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Structural Mechanics (E900528)

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

Credits	6.0	Study time	180 h	Contact hrs	22.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	English	lecture	30.0 h
		seminar	15.0 h

Lecturers in academic year 2018-2019

Offered in the following programmes in 2018-2019	crdts	offering
International Master of Science in Fire Safety Engineering	6	A

Teaching languages

English

Keywords

Structural Mechanics

Position of the course

This course describes the basic principles of Structural Mechanics, focusing on one-dimensional beam members.

Contents

Lectures:

L1
- Introduction and Overview
- Course structure and organisation. What is structural mechanics?

L2
- Structural forms
- Structural elements and examples. Strength and stiffness. Loads.

L3
- Global Equilibrium
- Forces and moments, point and distributed loads. Support conditions. Global equilibrium of structures. Concept of structural determinacy.

L4
- Free Body Diagrams and Stress Resultants
- Stress resultants in struts (axial load), shafts (torsion), beams (shear and bending) and pressure vessels (membrane forces).

L5
- Members carrying Axial Load
- Simple mechanical behaviour. Deformation (due to load and thermal strain).

L6
- Members carrying Torsion
- Torsion of circular shafts and other closed sections. Torsional stiffness and deformation.

L7
- Stress Resultants in Determinate Beams (1)
- Sign conventions. Shear force and bending moment diagrams

L8
- Stress Resultants in Determinate Beams (2)
- Relationship between w, V and M

L9
- Bending of Beams (1)
- Euler Beam Theory. Curvature. Plane sections. Bending strains

L10

- Bending of Beams (2)
- Euler Beam Theory. Elastic bending stresses. The neutral axis. Moment - curvature - stress - strain relationships.

L11
- Deflection of Beams
- Double integration of curvature to find deflection. Support boundary conditions. Beam stiffness

L12
- Superposition of Deflection
- Deflection coefficients. Superposition of deflections.

L13
- Geometric Section Properties
- Area, 2nd moments of area, Parallel axis theorem. Rectangular, circular, T and I sections

L14
- Composite Beam Sections
- Modular ration and equivalent section. Stress and strain diagrams.

L15
- Shear Stresses in Beams (1)
- Complimentary shear. Derivation of shear stress formulae.

L16
- Shear Stresses in Beams (2)
- Shear flow. Rectangular, box and flanged sections.

L17
- Combined Loading
- Combining axial, torsion, shear and biaxial bending stresses.

L18
- Limitations of SM2A theory; Revision
- An introduction to geometric and material non-linearity, stability, and warping.

Tutorials:
- T1 Equilibrium of free bodies
- T2 Axial load and torsion
- T3 Shear force and bending moment diagrams
- T4 Bending stresses in beams
- T5 Deflection of beams
- T6 Section properties
- T7 Shear in beams
- T8 Superposition of stresses
- T9 Revision (T1-T8)

Laboratory experiments:
- Experiment A: Euler Beam Theory
- Experiment B: Deflection of T and U Beams

A risk assessment form is to be completed before the start of each experiment.
AHEP outcomes: SM1b, EA1b, G2 (definite); EL6, P3 (possible)

Initial competences

None

Final competences

1 Describe the basic concepts of stress, strain and deformation in members carrying axial, bending and torsional loads
2 Determine how a statically determinate beam carries load using diagrams of bending moment and shear force, and evaluate the resulting elastic deflection of the beam
3 Analyse structural cross sections, so as to determine the elastic stress and strain distributions, as well as the deformations, resulting from axial, bending and torsional actions

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar

Extra information on the teaching methods

- Lecture Hours: 22
- Seminar/Tutorial Hours: 11
- Supervised Practical/Workshop/Studio Hours: 6

Learning materials and price

References

- J.M. Gere, "Mechanics of Materials", 6th Edition, Thomson. (A comprehensive treatment, and used in other Civil Engineering courses)
- J.E. Shigley, C.R. Mischke, R.G. Budynas, "Mechanical Engineering Design", 7th edition, McGraw Hill. (A fairly brief treatment, but also used in other Mechanical Engineering courses).

Course content-related study coaching

Evaluation methods

end-of-term evaluation

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

Written examination

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

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

The assessment will be made on the basis of: Written examination 100%

Calculation of the examination mark

Written Exam %: 85, Coursework %: 15, Laboratory experiments: 0%