Strength of Materials

Code: MK3SZILG04GX17-EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 2nd year, 1st semester

Its prerequisite(s): MK3STATG04GX17-EN (Statics)

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+2

Topics:

Statics review. Mathematical preliminaries (vector-, matrix- and tensoralgebra). Fundamentals of Strength of Materials. Elastic and plastic deformation. Physical interpretation of strain terms. State of deformation. State of stresses. Principal values of normal stresses, principal axes. Energy of strain. Constitutive equation (Hooke's law). Simple loadings (tension, compression, bending, torsion, shear). Sizing methods. Area moment and product of inertia. Polar moment of inertia. Determination of principal axes. Mohr's circle. Combined loadings (tension and bending, inclined bending, excentrical tension, tension and torsion, bending and torsion). Energy methods (Betti's theorem). Statically indetermined beams (Castigliano's theorem). Buckling of columns.

Literature:

Compulsory:

- Ladislav Cerny (1981): Elementary Statics and Strength of Materials, McGraw-Hill, ISBN 0070103399, 9780070103399
- László Kocsis (1988): Brief Account of the Lectures of Mechanics, Strength of Materials, BME
- Ferdinand P. Beer, E. Russel Johnston, Jr., John T. DeWolf (2006): University of Connecticut Mechanics of Materials, 4th Edition, © 2006, ISBN-13 9780073107950

Recommended:

- Stephen Timoshenko (1955): Strength of Materials: Elementary Theory and Problems, Van Nostrand
- Jacob Pieter Den Hartog (1961): Strength of Materials, Courier Dover Publications, ISBN 0486607550, 9780486607559

Schedule

1st week Registration week

2nd week:	**3rd week:**
Lecture: Fundamentals of Strength of Materials. Statics review. Mathematical preliminaries (vector-, matrix- and tensoralgebra).	**Lecture:** Elastic and plastic deformation. Displacement fields. Physical interpretation of strain terms. State of deformation.
Practice: Determination of stress resultants.	**Practice:** Practical examples for strain calculations.
4th week:	**5th week:**
Lecture: State of stresses. Principal values of normal stresses, principal axes. Energy of strain. Constitutive equation (Hooke's law).	**Lecture:** Simple loadings I.: tension and compression of prismatic beams. Fundamentals of sizing and control.

Practice: Practical examples for stress calculations. Strain energy calculations in beams.	**Practice:** Practical examples for tension and compression.
6th week:	**7th week:**
Lecture: Simple loadings II.: bending of prismatic beams. Area moment and product of inertia.	**Lecture:** Simple loadings III.: torsion of prismatic beams with circular and ring cross sections. Shear. Polar moment of inertia.
Practice: Practical examples for bending. Application of Steiner's theorem.	**Practice:** Practical examples for torsion and shear. **1st test.**
8th week: 1st drawing week	
9th week:	**10th week:**
Lecture: Combined loadings I.: tension and bending, inclined bending, excentrical tension.	**Lecture:** Mohr's circle. Determination of principal axes.
Practice: Practical examples for combined loadings.	**Practice:** Practical examples for determining principal stresses.
11th week:	**12th week:**
Lecture: Combined loadings II.: tension and torsion, bending and torsion. Sizing methods.	**Lecture:** Energy methods I.: Betti's theorem.
Practice: Practical examples for combined loadings.	**Practice:** Application of Betti's theorem for calculating deflections.
13th week:	**14th week:**
Lecture: Energy methods II.: Castigliano's theorem.	**Lecture:** Buckling of columns.
Practice: Application of Castigliano's theorem for indetermined beams.	**Practice:** Practical examples for buckling phenomena. **2nd test.**
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attendance at **lectures** is recommended, but not compulsory.

Participation at **practice** is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students can't make up a practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments to the course with them to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are two tests: the 1st test in the 7th week and the 2nd test in the 14th week. Students have to sit for the tests.

B, for grade:

The course ends in an **examination**.

The minimum requirements of the 2 tests and the examination is respectively 50%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade

0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

An offered grade: it may be offered for students if the average grade of the two mid-term tests is at least good (4).