Reg No: MSGB45/20201

Faculty of Health, Science and Technology
Mechanical Engineering

Syllabus

Solid Mechanics II for Bachelor students in engineering science

Course Code:	MSGB45
Course Title:	Solid Mechanics II for Bachelor students in engineering science *Hållfasthetslära II för högskoleingenjörer*
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has at least 60 credits in first-cycle course/s as entry requirements (G2F)

Major Field of Study:
MTA (Mechanical Engineering)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2019-03-14, and is valid from the Spring semester 2020 at Karlstad University.

Prerequisites
Mathematics for Engineers, 22.5 ECTS credits, Mechanics, 7.5 ECTS credits, Solid Mechanics, 7.5 ECTS credits, and Materials Engineering, 7.5 ECTS credits, or registration on the Mechanical Engineering programme or the Innovation and Design Engineering programme, or equivalent

Learning Outcomes
Solid mechanics is a basic engineering subject of great importance to engineering applications. The field of solid mechanics studies the interplay between forces on a body (a design) and the deformations and stresses that arise in the body due to the forces. The design may be performed in different materials. The aim of the course is to clarify how designs and components should be dimensioned to ensure that they will perform the intended technical function in a safe manner.

Upon completion of the course, students should be able to:
- analyse torsion in axes/beams in arbitrary cross-sections of statically determinate and indeterminate load cases,
- give an account of the concept non-uniform torsion and its effect, and explain when the theory of non-uniform torison should be used,
- apply the theory of non-uniform torison on simple cases of loading,
- describe cross-section quantities in skew bending,
- draw diagrams of shear force and bending moment, and calculate normal stress and deformation for beams under skew bending,
- calculate the stress distribution in twisted beams,
- describe the phenomenon of elastic instability and calculate the instability load for spring loaded solid linkage systems of exposed to pressure load,
- analyse the instability force of beams,
- calculate the stress distribution and deformation in sandwich beams under plane bending,
- give an account of the minimum of potential energy principle and use it for approximate calculation of beam deflection,
- use the energy method for approximate calculation of the buckling load of a pressure loaded beam,
- give a general overview of plate theory, and how the minimum of potential energy principle can be used for approximate calculation of plate deflection,
- give a general overview of how the energy method can be used to estimate the buckling load of a plate,
- judge the impact of cracks on the strength of materials under linear conditions using the stress intensity factor and the material's fracture toughness, as well as give an account for the limitations of linear theory,
- perform lifetime analyses using the Paris crack growth law,
- calculate natural frequencies of one-dimensional systems with discrete point masses,
- calculate natural frequencies and eigen modes for axial vibration, torsional vibration, and transverse vibration in thin structures with one or several point masses,
- calculate the vibration amplitude for forced vibration in thin structures,
- calculate natural frequencies and naturalmodes for a free-swinging wire, and
- calculate the effect of viscous damping support on the amplitude of forced vibration.

Content
The course deals with complex issues related to bending and torsion of beams and axes. The course also treats basic solid mechanical problems and issues of fracture mechanics and buckling stress. Students calculate the natural frequency and the vibration amplitude of dynamically loaded structures such as beams, bars, and axes. The minimum potential energy principle is treated both theoretically and as a basis for approximative analysis of beams and plates.

Reading List
See separate document.

Examination
Assessment is based on a written exam and a mandatory laboratory assignment.

If students have a decision from Karlstad University entitling them to special pedagogical support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades
One of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), U (Fail) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.