Reg No: MSGB31/20201

Faculty of Health, Science and Technology
Mechanical Engineering

Syllabus

Solid Mechanics for Engineering Science I for Master students in engineering science

Course Code:	MSGB31
Course Title:	Solid Mechanics for Engineering Science I for Master students in engineering science *Hållfasthetslära I för civilingenjörer*
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:
MTA (Mechanical Engineering)
TKA (Engineering Physics)

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, 15 ECTS credits, and Mechanics, 7.5 ECTS credits, 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:
- describe the concepts of force, stress, strain, deformation, and shear in one and several dimensions,
- describe the general equation of equilibrium,
- calculate principal stresses and principal strains and their directions,
- explain and make use of the relationship between stress and strain in an isotropic, linear, thermoelastic material,
- describe the elastic-plastic behaviour in metals and demonstrate knowledge of the concepts of yield strength and tensile strength,
- explain and use the concept of effective stress,
- explain and make use of the Ideal Elastic-Plastic Behaviour model in uniaxial stress states,
- analyse statically determinate and indeterminate trusses,
- analyse axial torsion in circular cross-sections of statically determinate and indeterminate load cases in terms of stress and deformation,
- describe cross-section quantities in plane bending,
- draw diagrams of shear force and bending moment, and calculate normal stress and deformation for beams under plane bending in statically determinate and indeterminate load cases,
- calculate bending shear force under plane bending,
- explain what the shear centre of a cross-section means and demonstrate ability to calculate its position,
- analyse tubes exposed to temperature load and/or inner surplus pressure,
- conduct fatigue analysis in terms of infinite life-span in stationary varying uniaxal stress state, and
- describe how the principle of virtual work can be used to derive the finite element method (FEM).

Content
The course deals with basic concepts such as stress, strain, and shear and their interaction in three-dimensional states of load. The course also treats bending, torsion and tensile stress in structures of thin oblong elements and tubes exposed to temperature load and/or inner surplus pressure. Basic solid mechanical problems and issues of fatigue are outlined. Students perform a computer laboratory analysis of a problem using the FEM method.

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.