Faculty of Technology and Science
Materials Engineering

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Technology and Science on 4 July 2011 , and is valid from the Spring semester of 2008 at Karlstad University.

Course Code: MTAD12
Deformation and Failure, 7.5 ECTS Credits
(Deformation och brott, 7.5 Swedish credit points)
Degree Level: Master
Progressive Specialisation: A1N (Second cycle, has only first-cycle course/s as entry requirements)

Language of Instruction
Swedish or English

Prerequisites
Mechanical engineering 75 ECTS cr including materials engineering 15 ECTS cr and solid mechanics 7.5 ECTS cr or quivalent

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

Learning Outcomes

The aim of the course is that students further develop their materials engineering understanding of the connection between mechanical properties, composition and structure of engineering materials and their application as well as knowledge of modern methods of materials investigation and skills in materials engineering laboratory work.

Upon completion of the course, students should be able to give a detailed account of:
- deformation properties in engineering materials,
- basic dislocation theory on deformation,
- slip and twinning deformation in crystalline materials,
- strengthening mechanisms in metallic materials,
- deformation of crystalline materials at high temperatures, especially creep deformation,
- deformation of polymers,
- failure mechanisms in engineering materials and notch effects,
- basic fracture mechanics,
- ductile- to brittle transition and deformation conditions,
- the connction between micro structure and fracture toughness,
- fatigue, low- and high-cycle fatigue
- fatigue crack growth,
- failure analysis with analysis, concepts and performance.

Students shoud also be able to:
- use methods of materials investigation such as light microscope, scanning electron microscope, hardness

measuring to examine and interpret micro structures and failure surfaces,
- compile laboratory results, literature studies and calculations in a technical report with an emphasis on materials engineering concepts and present it orally.

Content and Form of Instruction

The course deals with deformation and failure mechanisms, toughness and high temperature properties in engineering materials. It also deals with basic fracture mechanics and fatigue theory including crack growth. Course emphasis is on metallic materials but polymers and composites are also treated.

The course includes practical laboratory sessions where students work with metallographic test preparation, light microscopy, scanning electron microscopy with energy dispersive X-ray analysis, micro and macro hardness testing and impact testing. Students learn about modern methods for materials investigation and some skills in materials engineering laboratory work on a failure case and solve a material technical problem. Theoretical components with literature studies and calculations are also included.

Instruction is in the form of lectures, exercises and laboratory sessions. Based on a real failure case students solve a materials problem involving theory and laboratory work.

Reading List

See separate document.

Examination

Assessment is based on a written exam, mandatory laboratory attendance and on a written and oral presentation of a failure case.

Grades

One of the grades U (Fail), 3 (Pass), 4 (Pass with some distinction), or 5 (Pass with distinction) 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 assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

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