



COURSE SYLLABUS

Microstructural Engineering, 6 credits

Microstructural Engineering, 6 högskolepoäng

Course Code: TMER27	Education Cycle: Second-cycle level
Confirmed by: Dean Feb 1, 2017	Disciplinary domain: Technology (95%) and social sciences (5%)
Revised by: Director of Education May 27, 2019	Subject group: MA2
Valid From: Aug 1, 2019	Specialised in: A1N
Version: 2	Main field of study: Product Development

Intended Learning Outcomes (ILO)

On completion of the course, the student should

Knowledge and understanding

- basic understanding for how a microstructure is formed in a material during solidification
- knowledge about melt treatment and their influence on microstructure and properties
- knowledge about the solidification of metals the phenomena which influence the properties of products
- knowledge about how the microstructure and heat treatment influence the properties of cast metals

Skills and abilities

- ability to use the phase diagram to calculate and discuss in detail the formation of microstructure during solidification and phase transformations which occur

Judgement and approach

- able to suggest potential methods to improve the properties of cast materials.

Contents

Microstructure of cast metals, how it forms and its influence on mechanical and physical properties. Focus is on cast and heat treated metals. The course consists of two parts, where the first part covers process knowledge through the theory of solidification, phase diagram, and the solid state phase transformations which occur during cooling and during heat treatment. Melting and process control. The other part covers material properties and how these can be influenced by different treatments. Understanding of the relationship between process-microstructure-properties is core in this part of the course. Thus, the first part of the course is about the basic science of the formation of cast microstructures and the second half about the relationship between structure, properties and heat treatment.

The course includes the following parts:

- Overview of cast metals and phase diagrams

- Solidification mechanisms and microstructure formation, and their influence on mechanical and physical properties in cast metals
- Melt metallurgy, modification and nucleation and their influence on the solidification path
- Heat treatment
- The process-microstructure-property relationship
- Mechanical properties, static and dynamic
- Thermodynamic calculations

Type of instruction

Lectures, tutorials and laboratory.

The teaching is conducted in English.

Prerequisites

The applicant must hold the minimum of a bachelor's degree (ie. the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in Mechanical Engineering, or equivalent. Proof of English proficiency is required (or the equivalent).

Examination and grades

The course is graded 5,4,3 or Fail.

Registration of examination:

Name of the Test	Value	Grading
Examination ¹	4 credits	5/4/3/U
Assignments	2 credits	U/G

¹ Determines the final grade of the course, which is issued only when all course units have been passed.

Other information

Exemption from entry requirement allowed according to the selection groups of the program, where the course is included.

Course literature

Literature

The literature list for the course will be provided one month before the course starts.

“Phase Transformations in Metals and Alloys”, DA Porter and KE Easterling, Van Nostrand Reinhold.

“Fundamentals of Solidification”, W Kurz and DJ Fischer, Trans Tech Publications.