



## COURSE SYLLABUS

# Advanced Materials Technology, 6 credits

*Avancerad materialteknik, 6 högskolepoäng*

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|----------------------|-----------------------------------|-----------------------------|---|
| <b>Course Code:</b>  | TAMR24                            | <b>Education Cycle:</b>     | Second-cycle level                        |
| <b>Confirmed by:</b> | Dean May 21, 2014                 | <b>Disciplinary domain:</b> | Technology (95%) and social sciences (5%) |
| <b>Revised by:</b>   | Director of Education Aug 1, 2016 | <b>Subject group:</b>       | MA2                                       |
| <b>Valid From:</b>   | Aug 1, 2016                       | <b>Specialised in:</b>      | A1N                                       |
| <b>Version:</b>      | 2                                 | <b>Main field of study:</b> | Product Development                       |
| <b>Reg number:</b>   | JTH 2016/3049-313                 |                             |   |

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### 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
- knowledge about dislocations and their coupling to the deformation of materials

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

### Type of instruction

Lectures, tutorials and laboratory.

The teaching is conducted in English.

### Prerequisites

Passed courses 180 credits in first cycle, at least 90 credits within the major subject Mechanical Engineering including Engineering Materials 7,5 credits and Manufacturing Technology 7,5 credits, and 21 credits Mathematics, and English Language requirements corresponding to English A in the Swedish upper secondary school (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 <sup>†</sup> | 4 credits | 5/4/3/U |
| Assignments              | 2 credits | U/G     |

<sup>†</sup> 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

Mandatory literature:

Lecture slides and additional literature provided in PingPong.

Recommended course literature:

“Phase Transformations in Metals and Alloys”, DA Porter and KE Easterling, Van Nostrand Reinhold. (Bokus.com or Amazon.com)

Reference literature:

“Fundamentals of Solidification”, W Kurz and DJ Fischer, Trans Tech Publications.  
(Amazon.com)

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