MH2252 Casting Processing 6.0 credits

Gjutningens processteknologi

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

On 15/10/2019, the Dean of the ITM School has decided to establish this official course syllabus to apply from spring term 2020 (registration number M-2019-2226).

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Materials Science, Materials Science and Engineering

Specific prerequisites

Good knowledge of the production process for casting of metals corresponding to the course MH1024 Fundamentals of Materials Science - Metallic Materials, or the equivalent

Good knowledge in fluid dynamics of melts corresponding to the course MH1018 Transport Phenomena, or the equivalent.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student should be able to:

- Give example of and justify for the use of common casting processes for manufacturing of components, as well as blanks (workpieces)
- Apply and calculate fluid dynamic processes for metal flow at tapping and filling of a casting system for manufacturing of components, as well as blanks
- Explain principles and justify adopted models for heat transport at the moulding and solidification of metals
- Explain and justify for structure and structure formation in casted materials and the appearance of micro and macro segregations during solidification
- Explain the origin of casting defects such as shrinkage, gas porosity, slags, secondary phases and cracks and methods and processes to control and minimise these
- Dimension and simulate a casting system with the purpose of minimising casting defects and maximising yield, and present this in a scientific context.
- Describe and give examples of the complexity of a real industrial process chain for casting of components or blanks and present this during a seminar

Course contents

The course gives an overview over both component casting and processes such as ingot casting, continuous casting and direct casting and describe and explain the problems that can arise during metal casting, solidification and cooling.

In particular, the following is addressed during lessons, exercises and practical work:
Casting methods for production of components and manufacturing of sheet metal, steel bars and wire.
The hydrodynamics, flow processes at casting and the properties of the melt system in relation to its casting properties.
Models for solidification from thermal conductivity viewpoint for different casting processes.
The structure formation in different casting processes. Nucleation in and inoculation in melts.
Formation of micro and macro segregation.
Structural changes at heating, forming and homogenisation.
The solubility of gases in melts and precipitation of gas and of secondary phases during solidification.
Influence of shrinkage on solidification processes.
Cooling shrinkage, thermal stress and crack formation during cooling.
Analytical and numerical modelling of solidification and casting processes.

Examination

- STU1 - Study visit, 0.5 credits, grading scale: P, F
- TEN2 - Written exam, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- PRA1 - Practical training, 1.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Students who have not passed Study visits/Lab (LAB1, Written examination (TEN1) or Computer assignment (ÖVN1) according to previous official course syllabuses and assessment modules, will be assessed in the equivalent modules in the current official course syllabus.

Other requirements for final grade

An examination (TEN1; 3.8 credits)
Computer assignment (ÖVN1; 1.5 credits)
Lab and study visits (LAB1; 0.7 credits)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.