COURSE SYLLABUS

Modelling and Simulation of Casting, 6 credits

Modellering och simulering av gjutning, 6 högskolepoäng

Course Code:	TMSS27	**Education Cycle:**	Second-cycle level
Confirmed by:	Dean Feb 1, 2017	**Disciplinary domain:**	Technology (95%) and social sciences (5%)
Valid From:	Aug 1, 2017	**Subject group:**	MA2
Version:	1	**Specialised in:**	A1F
Reg number:	JTH 2017/590-313	**Main field of study:**	Product Development

Intended Learning Outcomes (ILO)

On completion of the course, the student should

Knowledge and understanding

- Have knowledge of analytical and numerical methods used to calculate the phenomena associated with casting.
- Understand that successful use of casting simulation in the development of new casting processes, new cast materials or solution of foundry technology problem has a positive impact not only on the process of economic balance, but also a positive environmental impact.
- Have understanding of how material properties and boundary conditions affect the calculation results.

Skills and abilities

- Have skills in using analytical formulas and programming the heating and solidification phenomena in relation to the casting of metallic materials.
- Have the ability to use professional software to optimize gating and the cast material properties.

Judgement and approach

- To evaluate which specific calculation methods and models to be used for various kinds of casting materials.
- Know the validation methods in order to determine if the calculation results reflect real phenomena associated with casting.

Contents

The present course discuss the development of prediction methods in connection to casting. Trends in programming and simulation of solidification phenomena are presented with examples from applications for process and materials development and solution of technological problems using casting simulation.

The course includes the following topics:

- The history of predicting methods related to castings manufacturing.

- Examples of successful use of casting simulation in research and industrial context.
- Basic heat transfer and solidification phenomena.
- Analytical methods of calculation of heat conduction and solidification.
- Numerical methods of calculation of heat conduction FDM, FDM-CV, in 1D and 2D.
- Numerical methods of calculation of solidification in FDM-CV.
- The enthalpy method in 1D.
- Validation of numerical calculation on commercial 3D simulation software.

Type of instruction

Teaching consists of lectures mixed with computational exercises. Laboratory work with the programming of own 1D program codes to calculate heat conduction and solidification. Laboratory in commercial 3D software to validate the own 1D solidification simulation codes.

The teaching is conducted in English.

Prerequisites

Passed courses 180 credits in first cycle, at least 90 credits within the major subject Mechanical Engineering, and 21 credits Mathematics and Advanced Materials Technology 6 credits and English Language requirements corresponding to English 6 orEnglish B in the Swedish upper secondary school (or the equivalent).

Examination and grades

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

The final grade for the course is based upon a balanced set of assessments. The final grade will only be issued after satisfactory completion of all assessments.

Registration of examination:

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

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 is preliminary until one month before the course starts.

Compendium based on "Fundamentals of Numerical Modelling of Casting Processes" by Jesper Hattel.
Formula and exercise collection of Attila Diószegi.
User's manual for program codes: MATLAB, Magma Soft, NovaFlow & Solid Flow 3D or Fluent.