Course code	Course title
METRO 003	Component Casting

Course summary

The goal of the course is to give a basic understanding about engineering and industrial design of components manufactured by casting..

Overview of casting methods, usefulness and product areas. Development trends. Different manufacturing methods and their characteristics. Machine and hand-moulding, shell-moulding, lost wax methods, lost foam, high pressure die cast methods, gravity die castings, low pressure die castings, squeeze-casting and new and special casting methods.

Overview of casting materials. Phase diagrams. Solidification of casting alloys. Metallurgical treatment. Use of alloying elements in cast irons and light alloys. Relation between microstructure and properties in cast materials. Shrinkage and gas porosity formation. Casting of new materials and composites. Melting and pouring.

Introduction to calculation and simulation of

- mould filling
- solidification time
- feeding
- residual stresses and deformations.
- local material properties

Design rules, related to filling and solidification phenomena

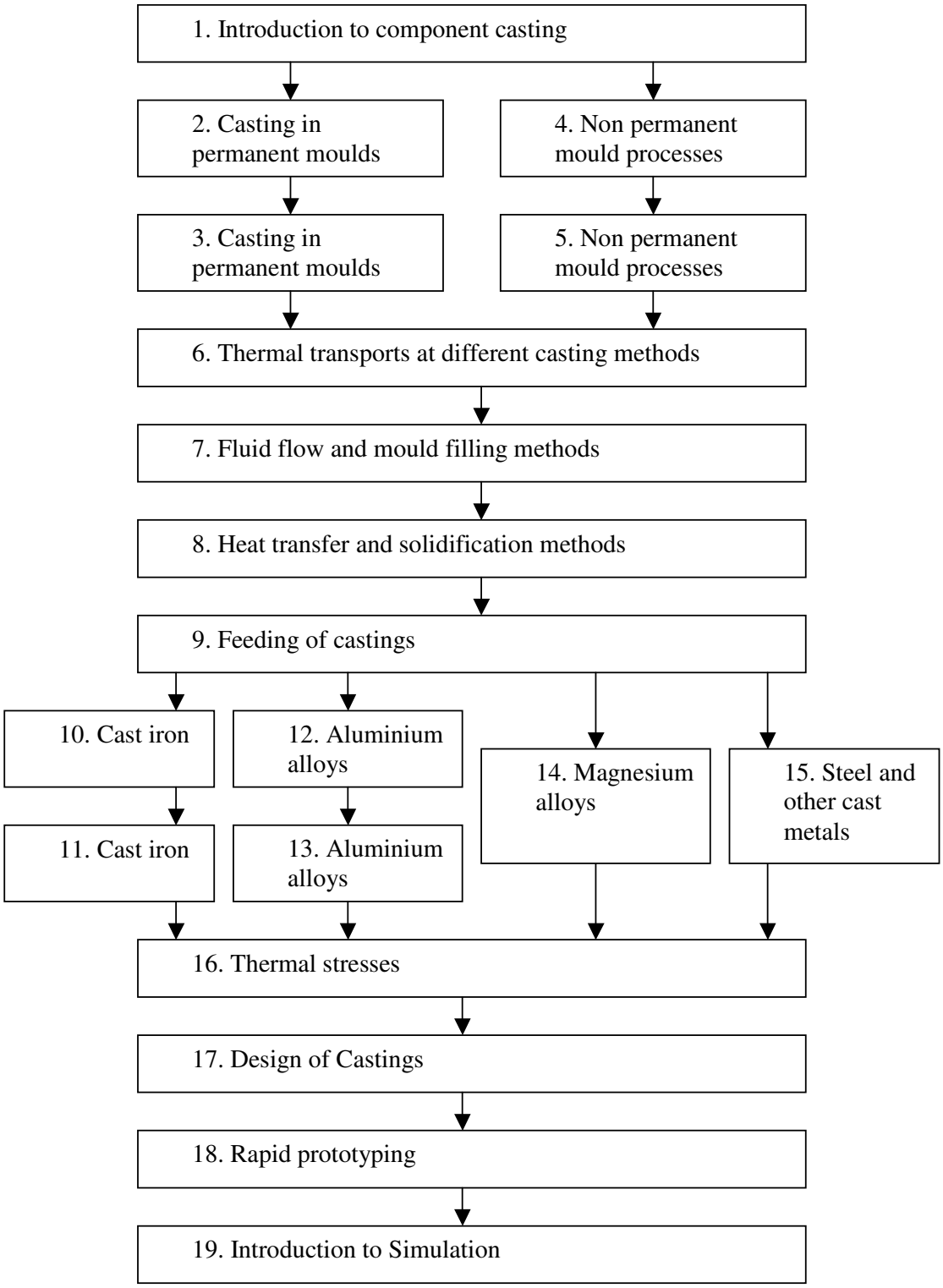
Lectures list

n.	Title	Summary	Lecturer	Duration
1	Introduction to component casting	This is a introduction to the course and a short description on the casting research at Component Casting at Joenkoeping University, Sweden.	Ingvar L Svensson Magnus Wessén	18’
2.	Casting in permanent moulds.	Gravity die casting, Low pressure die casting, Pressure die casting, with and without vacuum	Ingvar L Svensson	25’

3	Casting in permanent moulds.	Squeeze casting, Tilt casting, Vacuum methods	Ingvar L Svensson	29’
4.	Non permanent mould processes	Green sand moulds /Chemical bounded moulds, Lost foam, Vacum mould process	Ingvar L Svensson	23’
5.	Non permanent mould processes	Flaskless moulding, Sand moulding wheel compaction, Investment casting	Ingvar L Svensson	20’
6.	Thermal transports at different casting methods	Comparison of thermal transport properties, interface restrictions, in casting processes	Ingvar L Svensson	15’
7.	Fluid flow and mould filling	Gating systems, calculation of filling time, Bulk and surface turbulence, melt surface reactions	Magnus Wessén	30’
8.	Heat transfer and solidification	Calculation of solidification time in metal dies and in sand moulds	Magnus Wessén	25’
9.	Feeding of castings	Feeding mechanism, volume changes, Requirements for good feeding, use of simulation for feeder optimization	Magnus Wessén	28’
10	Cast iron	Graphite morphologies, lamellar graphite irons, compacted graphite irons, ductile irons, white iron, solidification, mechanical properties	Ingvar L Svensson	27’
11	Cast iron	Inoculation, solid state transformation, simulation of cast iron	Ingvar L Svensson	28’
12	Aluminium alloys	Soldification structure and metallurgical treatment. Aluminium alloys - Solidification microstructure and metallurgical treatment - Solution hardening - Grain refinement - Modification of Silicon eutectic	Ingvar L Svensson	33’
13	Aluminium alloys	Precipitation hardening / Heat treatment Metal Matrix Composites Metal foams Defects in Aluminium Castings	Ingvar L Svensson	22’
14	Magnesium alloys	Applications for cast magnesium alloys, trends, microstructure of Mg-Al alloys, mechanical properties	Magnus Wessén	29’
15	Steel and other cast metals	Introduction to applications where cast steels, Zn and brass are used. Overview of physical and mechanical properties as well as alloy contents.	Magnus Wessén	21’
16	Thermal stresses	Thermal stresses and strains formed due to mould- and casting constraints. Warpage, distortion, hot tears, cold cracks.	Magnus Wessén	31’

17	Design of Castings	Connections between parts with equal thicknesses Connections between parts with different thicknesses Design with consideration of cost for pattern and core boxes Design with consideration of cores Reduced number of cores Design with consideration of pouring Design with consideration of post treatment	Ingvar L Svensson	19’
18	Rapid prototyping	Pattern preparation, allowances, Casting - method, Pattern making, CAD / CAM, Rapid prototyping and short series.	Ingvar L Svensson	30’
19	Introduction to Simulation	Computer simulation and optimisation of casting processes and materials	Ingvar L Svensson	30’
				8h 10’

Lectures prerequisites chart



Each arrow means a prerequisite.