

MEC-E7005- Advanced Casting Technology D: Part process design course work

Exercise Instructions

Exercise is a pair work and its result will be a report. Below, detailed information on what there should be at minimum can be found. Shortly, a material and a suitable casting method is chosen for an analyzed product. Try to find all the possible material-method combinations (within reason) and exclude all those that are clearly not. From those that are possible, choose one material and one casting method *that is the most suitable* (and why!). After that, you can start to make design changes to your cast product to suit the needs for your chosen material and method specifics. When you have done design changes to the product, in the end, create a call for tender explaining the wanted material and method choices with all other relevant information.

Short background description

You and your partner work in an engineering design office. You will receive an assignment from a customer (course staff) where you must do analysis of a part and processes in a way that the part can be manufactured by casting. Your client will give some boundary conditions and preliminary plans, which you use as a backbone of design work. Your task is to prepare a report to your client of the design, and in addition, you will have to prepare call for tenders, which allows the customer to get quotes from various foundries.

Report

Try to make a clear and coherent report. No indicative number of pages, but please use font size 12 pt and line spacing of 1,5. It is recommended to take advantage of word processing – software features: styles, TOC (table of contents), source references, etc. to make the report more readable.

The report shall address the following issues:

1. Operating environment

Overview the requirements

- Loadings
- Operating temperature
- Pressure
- Corrosion environment
- Other requirements such as
 - Wear, machinability, etc.

→ Operating environment and other requirements specified in instructions will limit possible choices in regards of material and production method

2. Selection of cast material and method

Constraints and freedoms in section 1 determines all the realistic and possible casting materials and casting methods. Review possible alternatives for these.

→ Exclude materials and methods, which are not realistic. Remember to justify these choices.

2.1 Choosing material

Compare the product requirements to material groups. Take also into account the price of the product (material vs material in a rough sense) and is it possible to cast these materials in a Finnish foundry. Do not forget to justify/clarify why your choice is this in particular.

→ There are necessarily no single optimal solutions. So try to find a cost effective one and give alternatives if possible.

2.2 Choosing method

Compare possible molding techniques for chosen material solution. At least take note in selection the size of series/batch, dimensional stability, product forms/geometry. If possible, note the opportunity to cast in the Finnish foundry. State the reasons to your choice, and a brief overview of basic principles of chosen casting method. Think also about if there is something special that should be taken into account in the casting process (use of patterns, special equipment, must-do after-treatments, etc...).

3. Casting Design and Drawing

Make design changes to your product from the casting, solidification and molding point of views. You will get a rough drawing from “the client”. You need to make your changes to that design. In practice, these changes mean that it is important to select a parting line, design appropriate drafts and roundings etc. In addition, geometry changes can be done, if they are necessary. Again, do not forget to justify your choice. Ask for opinions on part functionality from course staff if you want to make changes that are more radical.

→ CAD modeling is part of this course. Two separate drawings are returned, one where you have sketched the changes due to material and method (cast geometry), then one where the areas that need to be machined are shown (e.g. are holes cast or machined?).

4. Call for Tender

Finally, do a call for tender of your final design. Please address it to one of the Finnish foundries (to show that you have sourced some information about foundries capabilities, but **don't actually send it anywhere**). Make a call for tenders according to standard **EN 1559-1:1997 - Founding: General Terms and Conditions** in accordance with the (more instructions on how to make a call for tenders can be found from ValuAtlas or when you are in this phase contact course assistance). Remember to make sure that you have chosen the foundry that can cast the planned materials and methods. Call for tender must include the selected material, the method and degree of tolerance in addition to the quality criteria / quality level.

→ Casting, like no other manufacturing techniques, will never achieve absolutely perfect adherence to specifications, and therefore the required quality level of a usable part ("a sufficient, but not over tight requirement") is an important part in a successful order-delivery process

Course lectures will give lots of information regarding this whole process, so pay attention and ask if something is not clear!