

ME 400 DEPARTMENTAL SUMMER PRACTICE GUIDELINES

In this project, you are assigned to establish a **fictitious factory** specialized in the products given below according to the last digit of your ID number.

Last Digit of ID	Group of Products
0	Food Processor (Mutfak robotu)
1	Electric scooter
2	Syringe Pump (for medical drug infusion)
3	Multitool pocketknife (with 33 functions)
4	Mini bench drill
5	Electrical power hand drill
6	3-DOF robot arm
7	Drone (for Photo Taking Purposes)
8	Electric lawn mower
9	Mini desktop lathe

Considering your fictitious factory, your summer practice report should be organized as follows.

1. **Introduction:** The aim and scope of summer practice should be presented briefly.
2. **Description of the company:**

Hints:

Please remember that even though this section is at the beginning of the report, you probably need to write this part the last, since you need to plan for manufacturing of the product, production volumes etc. to

determine what kind of and how many engineers you need or what type of organizational structure you should have. Please do not focus only on the product and do not determine the type of personnel needed only for manufacturing the product. You will also need project engineers to execute the projects, maintenance engineers, IT personnel, quality personnel, etc. to keep the whole plant up and running.

Overall, this section should include the following information:

- a. Find a proper name for your factory.
- b. Find a proper location for the factory and discuss the reasons behind selecting this location.
- c. Give an organizational structure of your factory, feel free to assign fictitious positions (do not forget to have engineering departments)
- d. Discuss the types of engineers hired in the company and mention about their duties
- e. Discuss your main area of business (How do you sell your products? Who are your customers? What are your main products?)
- f. Write a brief fictitious history of your company (founders, date of establishment, initial businesses, etc.)

3. Details of the Product:

Hints:

- *Since you are not working in a factory, you do not have a chance to see the parts (components) and sub-systems of the product physically. You need to make a search to determine the parts and sub-systems of the product. Product advertisements, maintenance manuals of the product, but most importantly, patents can be crucial in determining the parts and sub-systems of the product that your factory is manufacturing.*
- *Through patents and technical articles, determine the sub-systems, assemblies that your product may need. Determine the parts needed for each sub-assembly, which will go to your Bill of Materials (BOM). Please note that the number of parts can explode very quickly. Try to have an amount of detail where your BOM has at most 50 parts.*
- *Determine which assemblies and/or component(s) will be manufactured in your factory and which ones will be purchased from suppliers (Make or Buy Decision). Generally, criteria that are considered in this decision are as follows:*
 - *If possible, parts that are most critical to the performance of the product and safety of the users should be manufactured in the factory since quality control in your plant is always more effective than trying to regulate the quality of your supplier's product.*

- *Parts that require higher technical qualification than your factory's and engineers' capabilities can be purchased.*
- *Parts that require big investments to manufacture can be purchased.*
- *Parts that have dangerous or environmentally harmful manufacturing processes can be purchased.*
- *The parts that fall far from your company's expertise area can be purchased.*
- *Draw a solid model for 5 parts that you decided to manufacture in your factory. Please note that the complexity of the parts that you choose for the solid model should be appropriate. Avoid choosing too simple parts, where your report will be too simple and you will not be able to reflect your knowledge and the research in your report, resulting in a failing grade. The parts you choose should be manufactured at least by 3 production steps.*
- *For the 5 parts you created the solid model and technical drawings, you will need to explain the R&D studies to reach these parts designs. In this part, we do not ask you to perform the technical analysis but rather think of yourself as the lead R&D engineer describing the other engineers the type of analysis you expect from them to reach the designs of the parts.*
For instance, for a simple gearbox assembly working in a high-temperature environment in your product, you may write that the following analysis will be required during the design of the product:
 - *Strength of materials analysis to determine the forces that will be exerted on gear tooth as well as shafts.*
 - *Strength of materials analysis to determine the stresses on the gearbox parts using finite element method.*
 - *Strength of materials analysis for fatigue life.*
 - *Heat transfer analysis for determining the maximum temperatures that may be reached during the operation of the gearbox.*
 - *Materials analysis and evaluation of degradation of material properties of the parts of the gearbox under these high temperatures.*
- *You will need to determine the production steps for these 5 parts, such as turning, milling, casting, injection molding etc. The order of these production steps is also important for determining your production and assembly lines.*

So, your report should contain the following information for this section:

- a. Write down the main function and features of your product

- b. Create a multi-level bill of materials (BOM) schematically. Start from the product, continue with the assembly and finish with parts (Visit <https://mub.me/ChL> for a tutorial on how to create a multi-level BOM.)
- c. Explain the function of each assembly and part in detail.
- d. Do make-or-buy decisions for the parts in BOM and justify your decision (Determine at least 5 parts that you decide to manufacture in your plant).
- e. Make a 3D model of 5 parts (that is going to be manufactured in your factory) using a CAD software.
- f. List and explain the type of engineering analysis that the design and R&D engineers should be performing for the design of parts in (3e).
- g. Generate 2D technical drawings of the parts using the solid models you generated in (3e) (with necessary views, dimensions, materials, tolerances, scale, surface quality, etc. by using a proper template)
- h. Give detailed production steps of the parts in (3e)

4. Assessment of Production

Hints:

- *List the machines that you need to manufacture the parts in (3e). If you can find a machine from online sources that you need, you may put brand names and models of these machines that are needed for the production of these parts.*
- *Plan for the layout of these machines keeping in mind the order of the manufacturing processes as well.*
- *What kind of volume do you target for manufacturing? Considering the production steps and times required for each part in (3e), determine scheduling for your manufactured parts, such as how long each machine should be working per day. How many shifts do you need each day?*
- *Considering the function of these 5 parts in (3e) and their assembly with the other parts, which are the critical dimensions of these parts (for the performance and safety of the assembly that the parts is in)? This information will be important for production control, in terms of which dimensions to measure as the part of quality control (Section 4d).*

So, your report should contain the following information for this section:

- a. Select proper machines and machine tools to produce the parts in (3e).
- b. Make the plant layout based on (4a) (layout of machines and machine tools, the layout of assembly lines, material handling methods, raw material storage, storage methods used for semi-finished and finished products)
- c. Production planning and scheduling for the parts in (3e).
- d. Quality control procedure for the parts in (3e)

5. **Cost analysis of a sample workpiece**

Make the cost analysis of one of the parts in (3e) (Do your best to collect best information for the overhead cost of the machines, energy costs, machine tool costs etc.)

6. **Quality assurance:**

Assessment of quality assurance and quality control systems used for raw materials, parts, and products. At this point, you know which parts and/or assemblies are being manufactured in your factory and which parts and/or assemblies are being purchased from outside. Think about what kind of supplier controls you need and acceptance tests (for parts and/or assemblies you purchase from outside and raw material of the product you are manufacturing) you may need to ensure the quality of all parts of your product. Try to determine the relevant quality standards through research.

7. **Marketing and future plans**

Imagine that you are manufacturing and selling the given product in expected volumes successfully. What products will be reasonable next product(s) for the continuation of the cash-flow and growth of the company?

8. **Conclusion**

The experience gained during the preparation of the summer report, please elaborate on how the research you performed during the preparation of the report improved your knowledge as an engineer.