MECHANICAL DESIGN
PART 1

INTRODUCTION TO MECHANICAL & INDUSTRIAL ENGINEERING

MEC 130

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Mechanical Design

Engineering Design is the process of creating a system, component, process, or a service to meet prescribed desired needs.

- Design is an *innovative process*.
- Design may follow an *iterative process*.
- Design is also a *decision-making process*.

Mechanical Design means the design of components and systems of a mechanical nature (*machines*, *products*, *structures*, *devices* and *instruments*).

- Mechanical design includes many aspects of *mathematics*, *materials*, and the *engineering-mechanics*.
- A mechanical design engineer should have knowledge of *mechanics of materials*, *dynamics*, and *materials science*.

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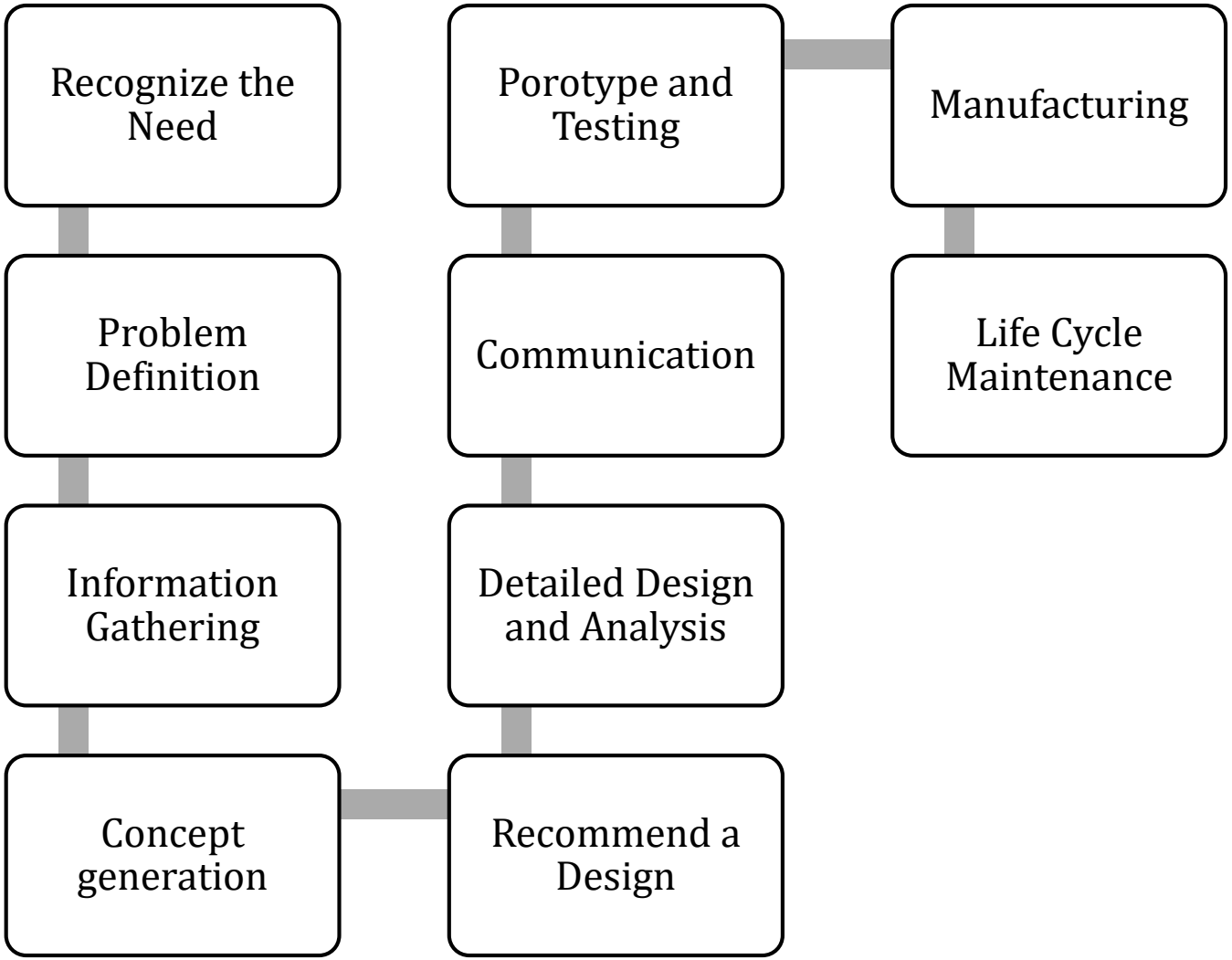
Design Process



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Illustrative Example of a Mechanical Design Process

→**Recognize the Need:** Lift a Car

→**Problem Definition (Identify Problem):**

- Define objectives and goals.
- Define the design specifications.
- Questions should be asked to define the design specifications.

Note: Anything which limits the designer's freedom of choice is a *specification*. **Design specifications** are set of constraints and criteria used to evaluate the design.

Design Specifications to be Considered:

strength - cost - flexibility - reliability - safety - control - thermal properties - weight - stiffness - corrosion - life time - surface finish - wear - noise - lubrication - friction - styling - maintenance - size – working space - manufacturability - speed – feedrate.

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→**Recognize the Need:** Lift a Car

→**Problem Definition (Identify Problem):**

To Design a Car Lift, the following questions should be asked:

- *Lifting or pulling?*
- *Why? For car repairing, oil change, or handling?*
- *Allow for car rotation?*
- *Fixed or movable machine?*
- *Wheel supported or chaise supported?*
- *Lifting different types of cars or only one type?*
- Maximum capacity?

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Illustrative Example of a Mechanical Design Process

→**Recognize the Need:** Lift a Car

→**Problem Definition (Identify Problem):**

→ **Information Gathering:**

- Gathering the information that help you during the design process.
- Sources include:

textbooks - journals & magazines - technical reports - company catalogs - web pages - handbooks - company reports - patents - people

→**Concept Generation:**

- Collect possible ideas and initial suggestions about the design. (*collect and record all ideas*).
- Brainstorming.

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Brainstorming:

- People who are familiar with the general nature of the problem meet and discuss the possibilities of solving it.
- Everyone says what comes to mind.

Rules of Brainstorming: (1) no judgements; (2) unconventional ideas are better; (3) more ideas are recommended.

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Mohamed Shaat
Intro. to Mec & Ind. Eng. (MEC 130)

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Illustrative Example of a Mechanical Design Process

→**Recognize the Need:** Lift a Car

→**Problem Definition (Identify Problem):**

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→**Concept Generation:**

→ **Recommend a Design:**

Identify the pros & cons of each design, and recommend the best.








Illustrative Example of a Mechanical Design Process

→**Recognize the Need:** Lift a Car

→**Problem Definition (Identify Problem):**

→ **Information Gathering:**

→**Concept Generation:**

→**Recommend a Design:**

→**Detailed Design & Analysis:**

- Do the necessary calculations needed for the detailed design.
- Use mathematical models to analyze and to evaluate the design.
- Mathematical models are complex to be developed.
- Use simulation techniques such as Finite Element Modeling (FEM).
- For optimum design, many trials are needed.

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→**Concept Generation:**

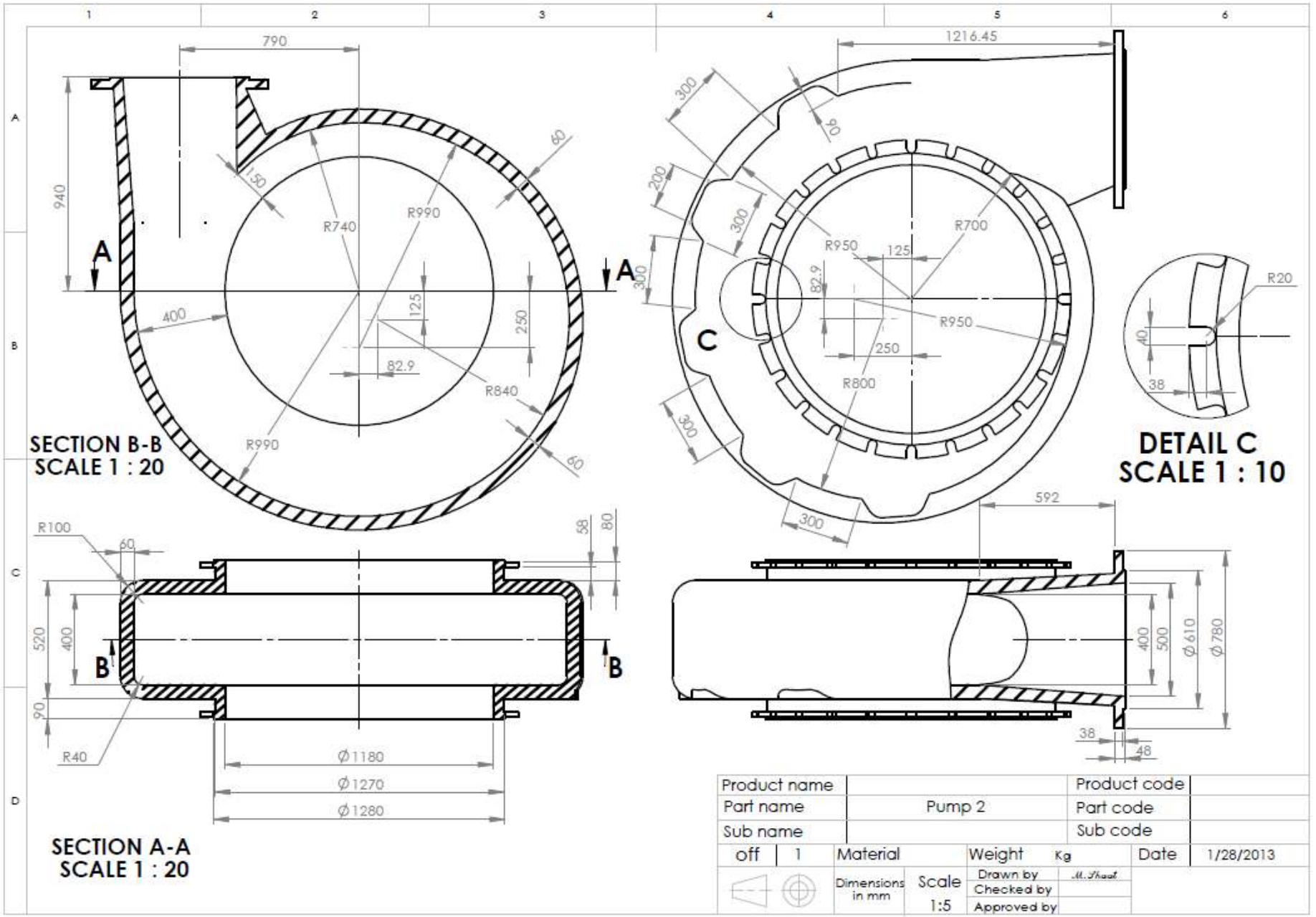
→**Recommend a Design:**

→**Detailed Design & Analysis:**

→**Documentation:**

- Use design reports, oral presentations, and graphics to document your design.
- Your objective is to convince people with your design.
- *Graphics:* is using mechanical drawing and drafting of a mechanical design.

MECHANICAL DESIGN



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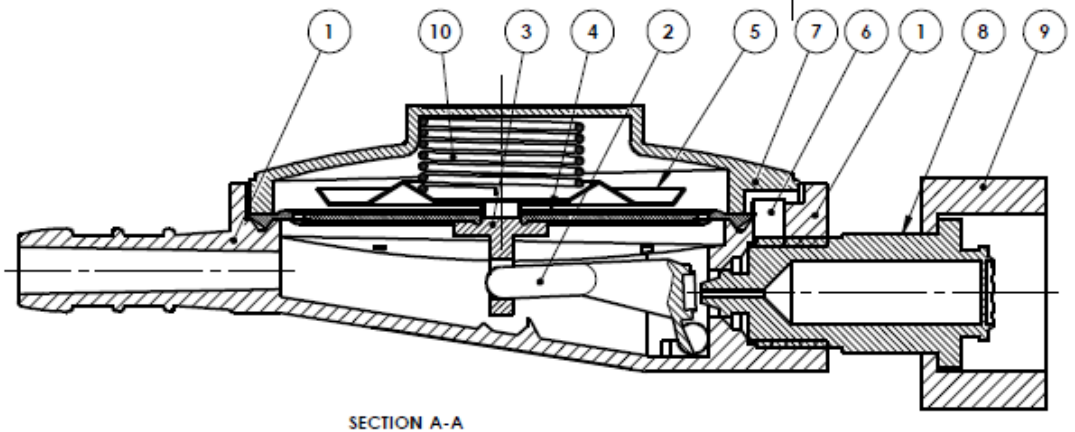
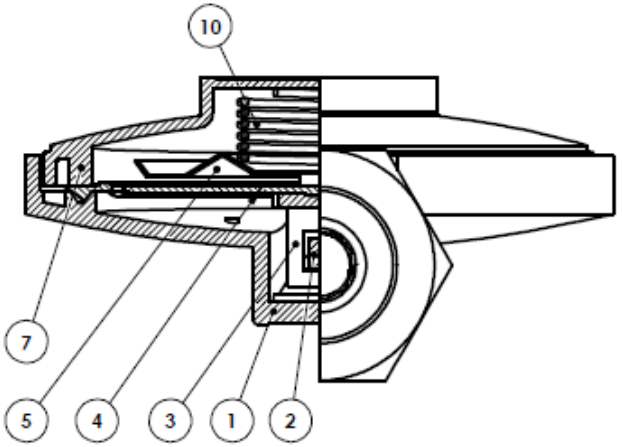
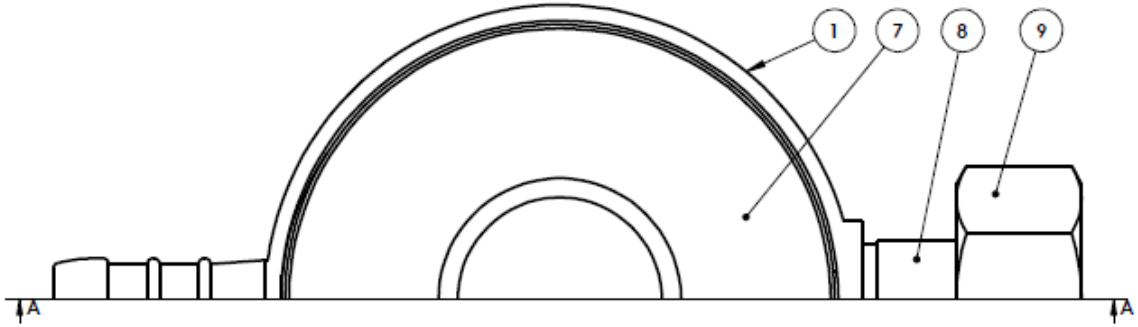


SECTION A-A





ITEM NO.	PART NUMBER	QTY.
1	Body Half 1	1
2	Locker	1
3	Adapter	1
4	Inner Ruber	1
5	Inner Sheet	1
6	pin (∅4 x 6)	1
7	Body Half 2	1
8	Vent	1
9	Nut (M20x2)	1
10	Spring (∅20 x ∅1 x P=8mm, H=57mm)	1

Product name	UNION			Product code	
Part name	Gas Connection			Part code	
Sub name	Gas Connection			Sub code	
off	1	Material	Weight	Kg	Date 18/10/2013
	Dimensions in mm	Scale 1:2	Drawn by	Eng. Yhaat	
			Checked by		
			Approved by		

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→**Concept Generation:**

→**Recommend a Design:**

→**Detailed Design & Analysis:**

→**Documentation:**

→**Prototype & Testing:**

- Produce a prototype of your design and test it according to the dfined design specifications.

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→ **Information Gathering:**

→**Concept Generation:**

→**Recommend a Design:**

→**Detailed Design & Analysis:**

→**Documentation:**

→**Prototype & Testing:**

→**Manufacturing:**

- Develop detailed drawings and work orders to production engineers & industrial engineers for the design production.

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→**Documentation:**

→**Prototype & Testing:**

→**Manufacturing:**

→**Life Cycle Maintenance:**

- Provide information on the life cycle of the different components of your design, and the necessary maintenance schedule.