



**University of Technology**  
**Department of Mechanical Engineering**  
**Branch of General Mechanics Engineering**

# *Mechanical Engineering Design II*

## *Fourth year*

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**Lecturers: Design Group**  
**2014-2015**

## **REFERENCES:**

- 1. Machine Elements in Mechanical Design, by: Robert L. Mott.**
- 2. Machine Design, by: Black & Adams.**
- 3. Standard Handbook of Machine Design, by: Joseph E. Shigley & D.N. Mischke.**
- 4. Machine Design, by: D.N. Reshetov.**
- 5. Design of Machine Elements, by: Virgil M. Faries.**
- 6. Machine Design, by: Khurmi – Gupta.**
- 7. Machine Design, by: Roberts H. Creamer.**
- 8. Machine Elements, by: V. Dobrovolskey.**
- 9. Machine Design, by: Hall, Holowenko, (Schaum's Series).**
- 10. Design Methods, by: G. Jones.**
- 11. Engineering Design Methods, by: Nigel Cross.**
- 12. Optimization Methods for Engineering Design, by: Richard L. Fox.**
- 13. Optimization of Mechanical Elements, by: Ray Johnson.**

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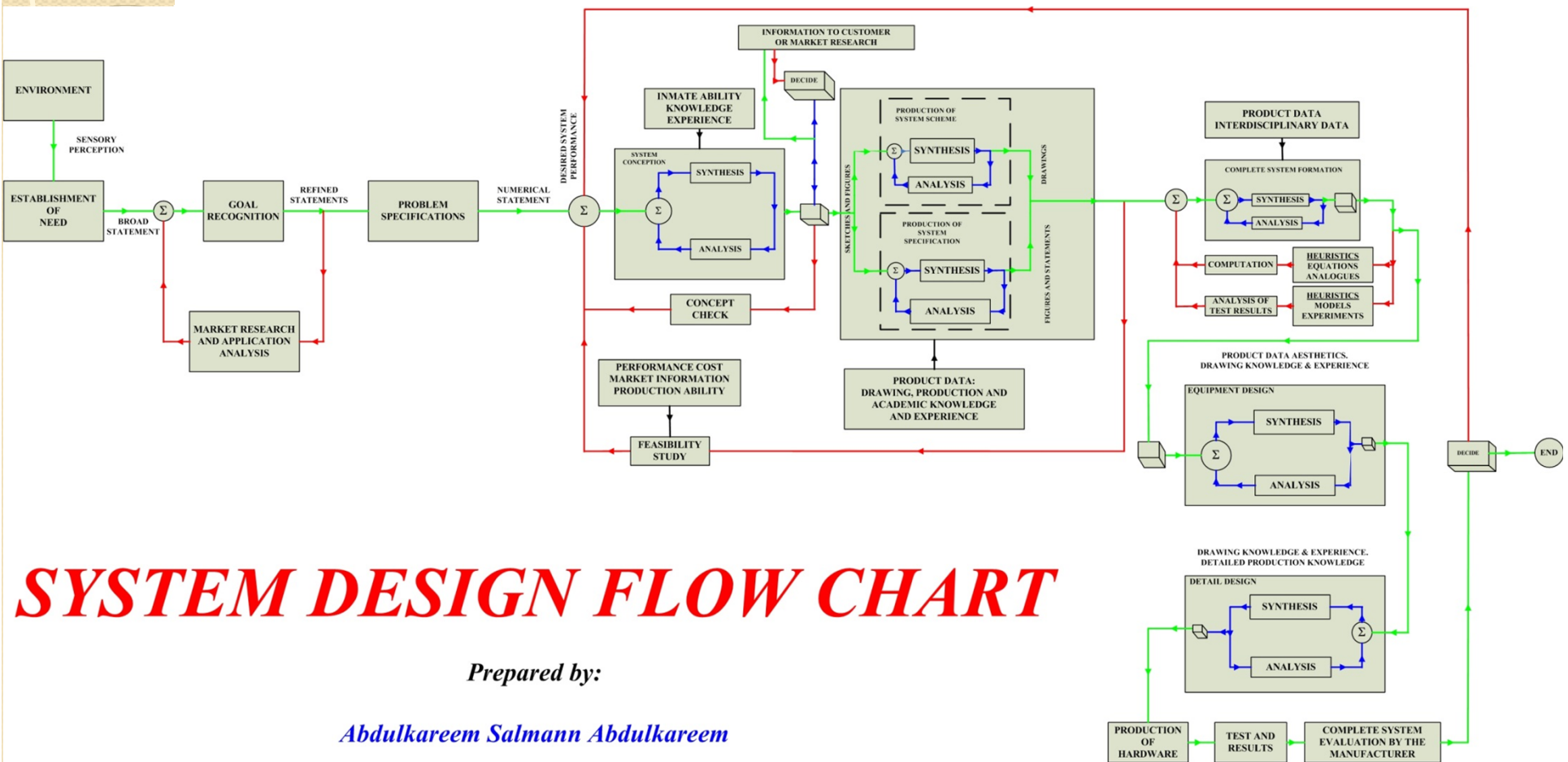
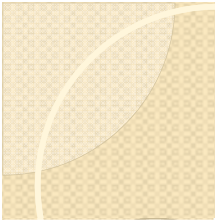




# **Mechanical Engineering Design II**

**First Lecture**

**Structure of Lectures**



# SYSTEM DESIGN FLOW CHART

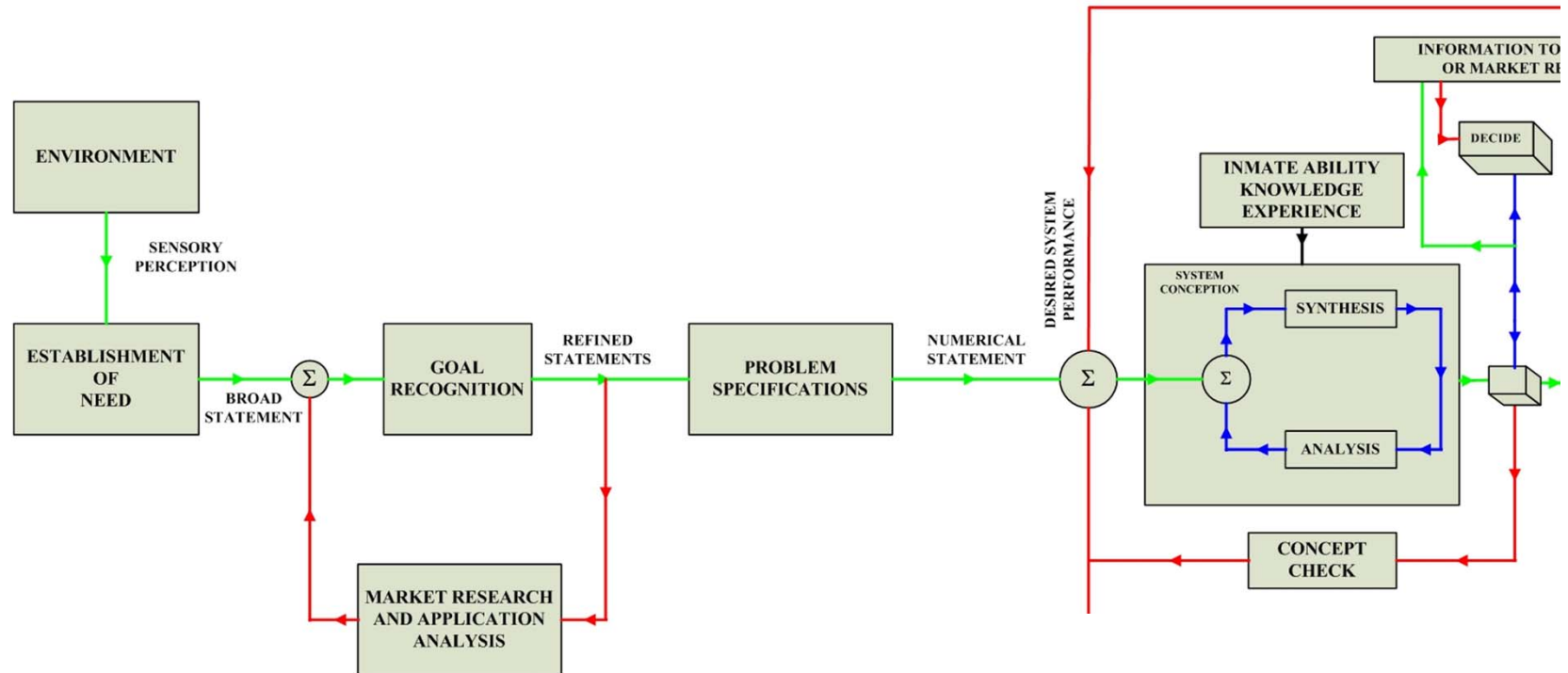
Prepared by:

Abdulkareem Salmann Abdulkareem



# First Semester

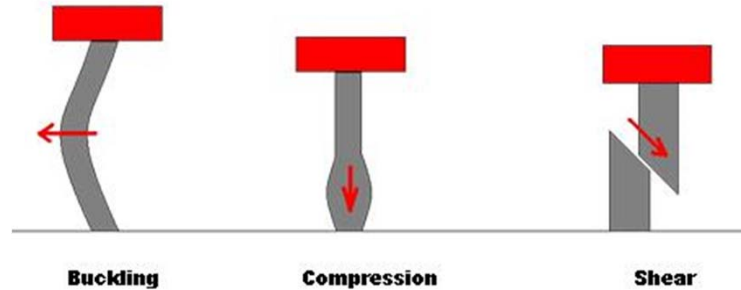
## Part 1



10%  
Mark

## Part 2 Mechanical Elements Design

### ➤ Column Analysis and Design



### ➤ Chain Design



### ➤ Introduction to Mdesign Program and Parametric Analysis Problems



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Mark

**First Semester Examination**

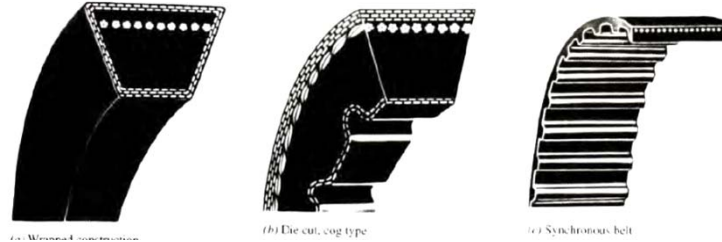
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Mark

## Part 1



## Part 2 Mechanical Elements Design

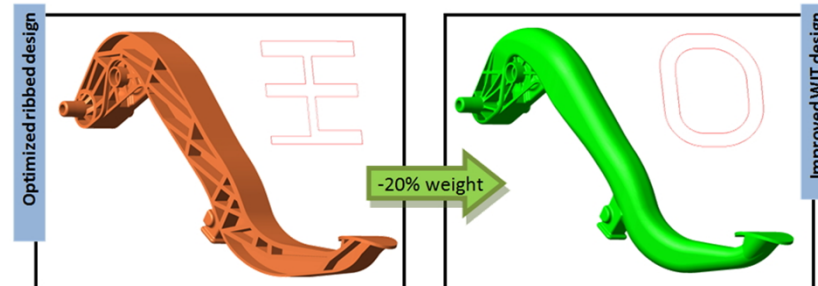
### ➤ Belts Design



### ➤ Spur, Helical, Bevel and Worm Gear Design



### ➤ Introduction to Optimum Design



5%  
Mark

Second Semester Examination

10%  
Mark

Final Examination

50%  
Mark





# **Mechanical Engineering Design II**

## **Second Lecture**

### **Introduction to the system design flow chart**

## Summary of the flow chart

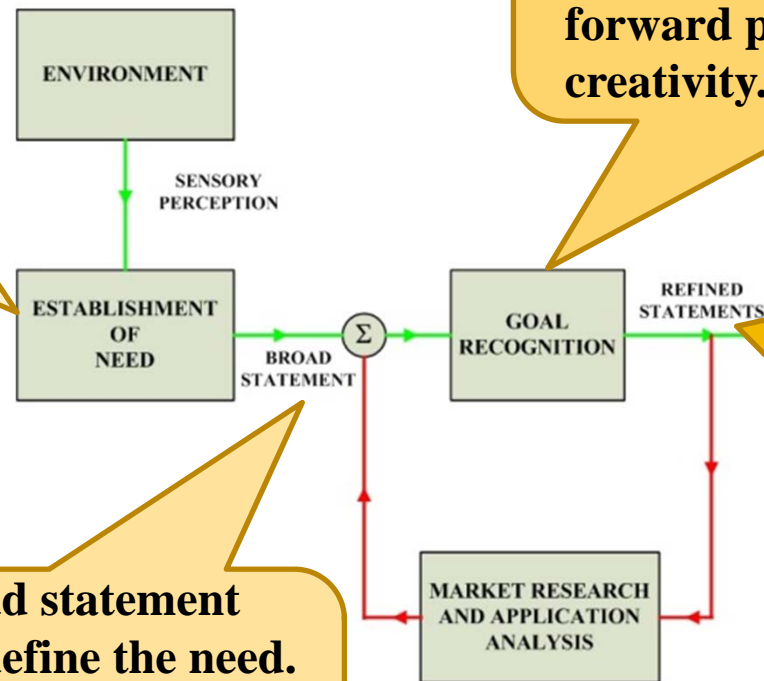
1- The entry to the flow chart starts with the Establishment of need for the particular system.

2- Then the Broad statement can be made to define the need.  
These statements are analyzed to obtain a goal, which will satisfy the need.

3- The forward path, which is a Goal-recognition, is a Synthesis and the output from the forward path is a product of creativity.

5- The Refined statement then made to specify the particular solution of the problem, but describe the goal toward, which we are heading.

4- The feed back function, (Market research and Application analysis), is essentially an Analysis. The results of this analysis are compared with the Desired Input, (the comparison element), which is the Broad statement from the Establishment of need.





**Application of the items from no.1 to no.5 is as follows, using the following example:**

## **Design Equipment to convert waste**



## 1- Environment:

Humankind has always produced pollution and waste. The industrial revolution saw a major increase in activities producing waste as well as useful manufactured goods. Nowadays, with the world population increased and new awareness of what he is doing to his environment, the need for an efficient ways of handling waste materials has become important.





## 2- Establishment of need:

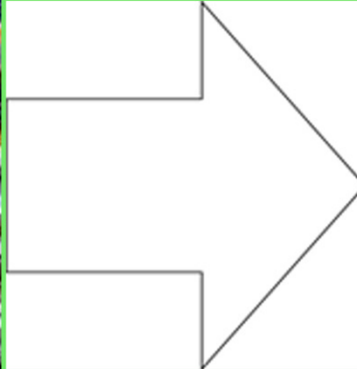
Waste materials may be broadly categorized under the following headings:

- Waste that can be recycled to its original form, re-melted and reused such as scrap materials.
- Waste that can be used as it is to manufacture some other useful items.
- Waste that can be converted to something useful in another form such as wood-waste that converged to chipboard.
- Waste that can be recycled, reused, or converted and then should be dumped.



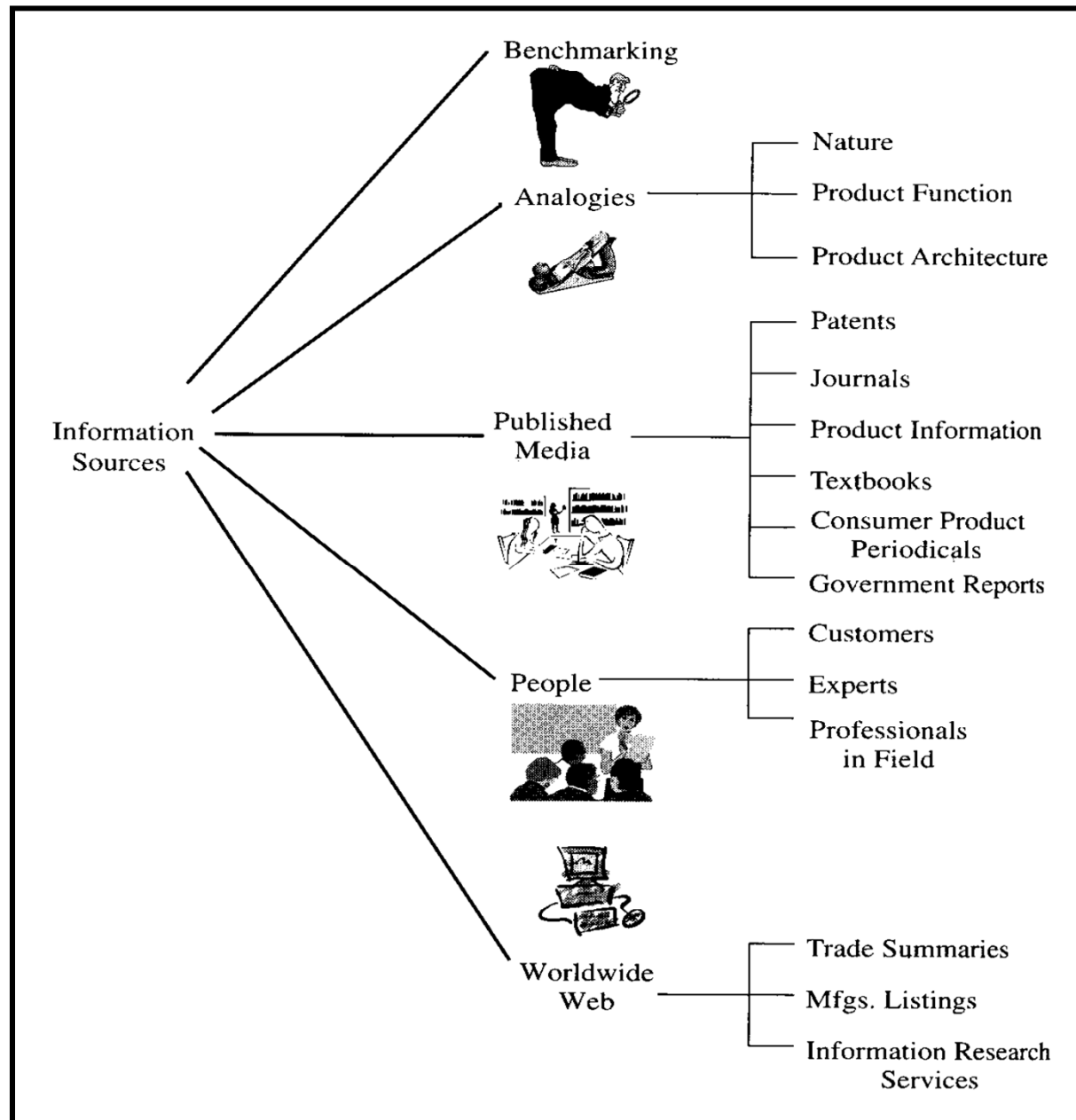
### 3- Goal Recognition:

The company would be appearing to be in an apposition to manufacture and market equipment, which would convert waste of a certain category in to a form of energy.





## 4- Market Research:



## **Writing Questionnaire: (as an application of market research)**

**Questionnaires are used to collect usable information from the number of large population. They can be represented by two methods:**

- **Direct contact (face –to-face) situation;**  
where the researcher can explain the purpose of the study, clarifying points and answering questions that arise.  
However, bringing a group to full the questionnaire is difficult and takes time.



- **Mailed questionnaire;** where it can reach many peoples in widely scattered areas quickly and easily in the same time and at low cost. However, the return of their answers may be half of the questions that had been sending.



## Questionnaires are in three forms:

**Closed form;** facilitate process of tabulated and analysis. It consists of a prepared list of questions and a multiple choices of possible answer, to indicates his reply, respondent marks YES or NO, checks, circles, and etc.



**Open form.**



**Pictorial form;** this questionnaire presents responders with drawings or photographs rather than writing statement from which to choose answer.



**The following is an example of a how you can start writing a questionnaire in our case.**

**Please tick the box or the boxes that are relevant to your situation:**

**Q.1) are you:**

- a) A government manufacturing company ☐
- b) A service organization ☐
- c) A public company ☐
- d) A hospital ☐

**Q.2) do you employ**

- a) Less than 500 person ☐
- b) Between 500 to 10000 person ☐
- c) More than 10000 person ☐

**Q.3) do you produce waste materials**

- a) Yes ☐
- b) No ☐

**Q.4) do you**

- a) Dispose of your own waste ☐
- b) Have it collected ☐
- c) Both ☐

**Q.5) if your waste is collected**

- a) Does this cost you money ☐
- b) Have it collected free of charge ☐
- c) Receive a payment for it ☐

**Q.6) do you recover any heat from your waste**

- a) Yes ☐
- b) No ☐

**Q.7) if the answer of (Q.6) is YES, do you use the heat for any of the following**

- a) Space heating ☐
- b) Hot water service ☐
- c) Process requirement ☐

**Q.8) has the quantity of the waste materials that you produce**

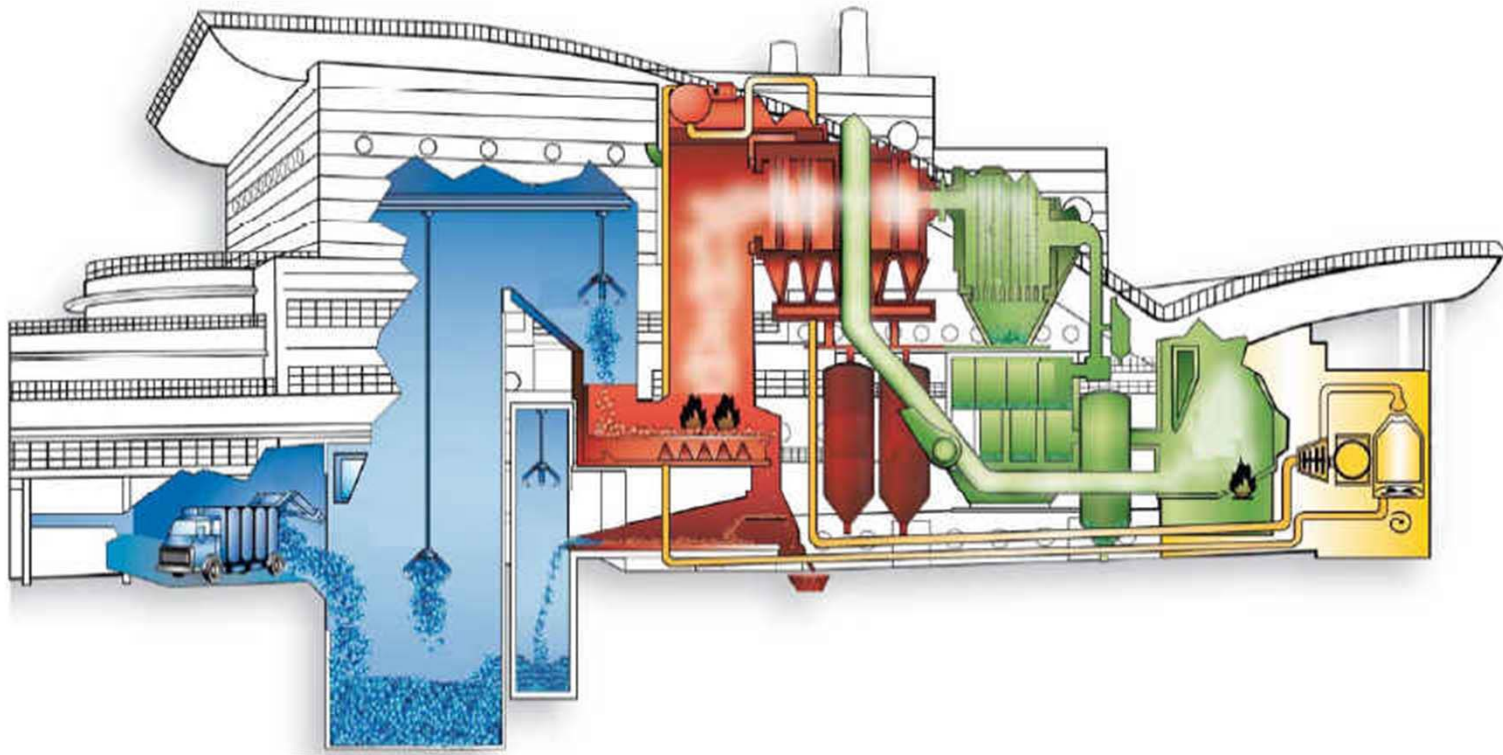
- a) Increased in the recent years ☐
- b) Decreased in the recent years ☐
- c) Remain unchanged ☐



## 5-Refined Statement:

Based on the returned answers, the system must provide:

- Suitable waste storage
- Automatic handling of waste
- Since there may be an energy requirement when waste is not available, then some alternative means of providing energy must be offered as an extra.
- Some means of converting the waste materials into a readily usable form of energy.
- The plant must provide safety acts and clean air acts.
- Small packaged unit is preferred.





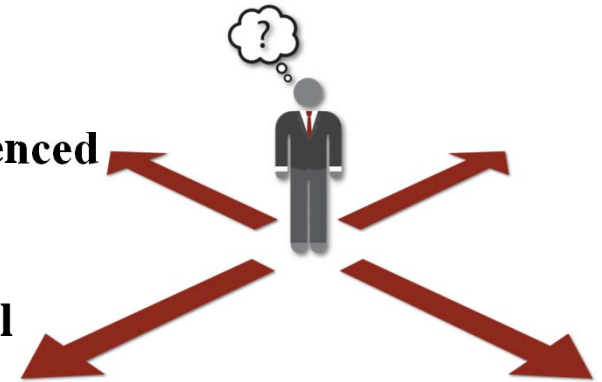
# **Mechanical Engineering Design II**

## **Third Lecture**

### **Advantages of Questionnaire and how to write an Initial Specification of the System**

## Advantages of questionnaire:

- Identifying the design decision that is to be influenced by replies to the questionnaire.
- Identifying the kind of information that is critical to the taking of these decisions.
- Identifying the kind of people who having a rapid accept to the kind of information needed.
- The appropriate sample was selected.
- From the replies, taking the most helpful data.

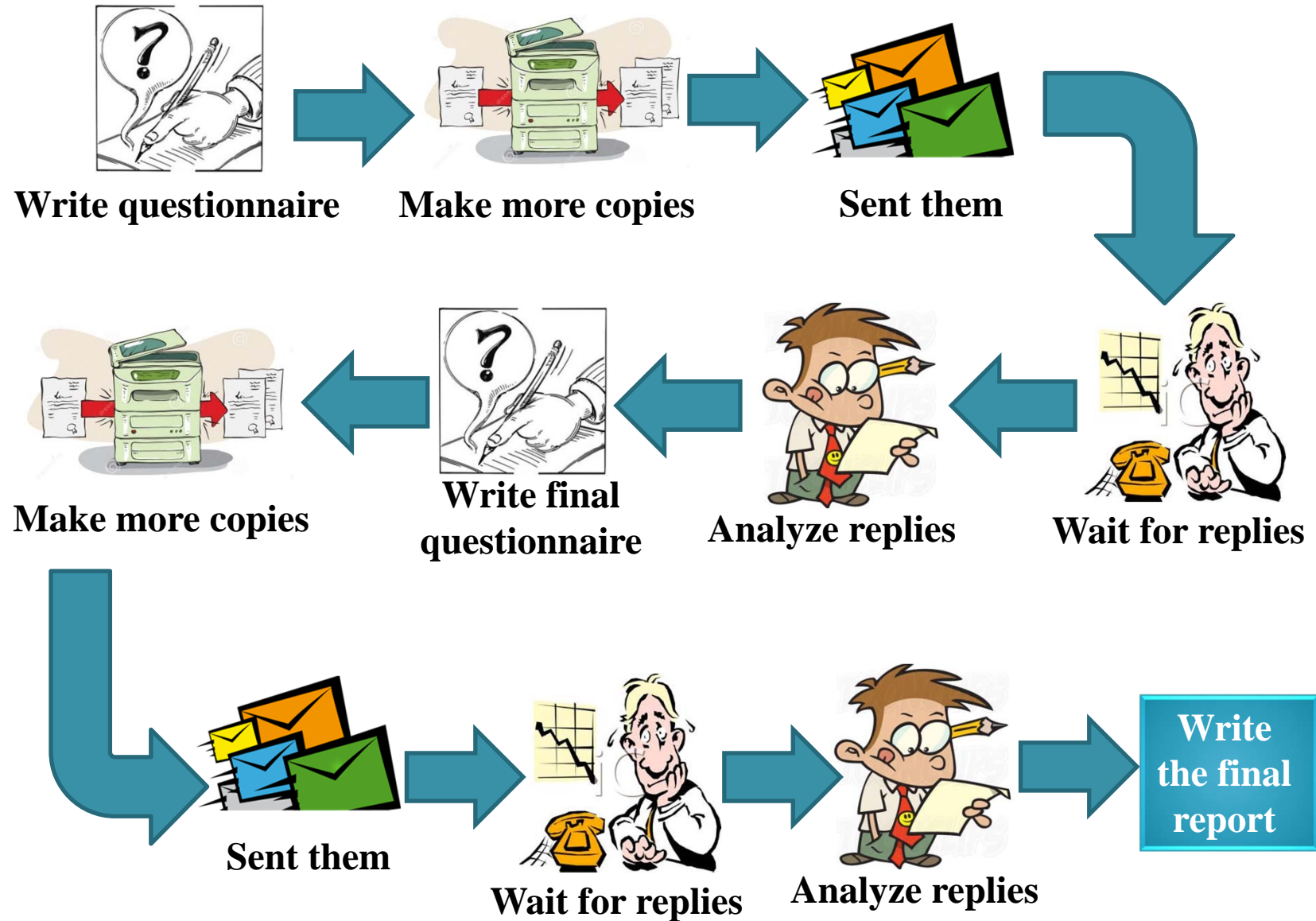


## **How to write the questionnaire:**

- 1. Ask for minimum information needed for the purpose.**
- 2. Be those, which the information is able to answer.**
- 3. Require an answer of YES or NO, or a simple one, or something equally definite and precise.**
- 4. Be such as will be answered truthfully and without bias.**

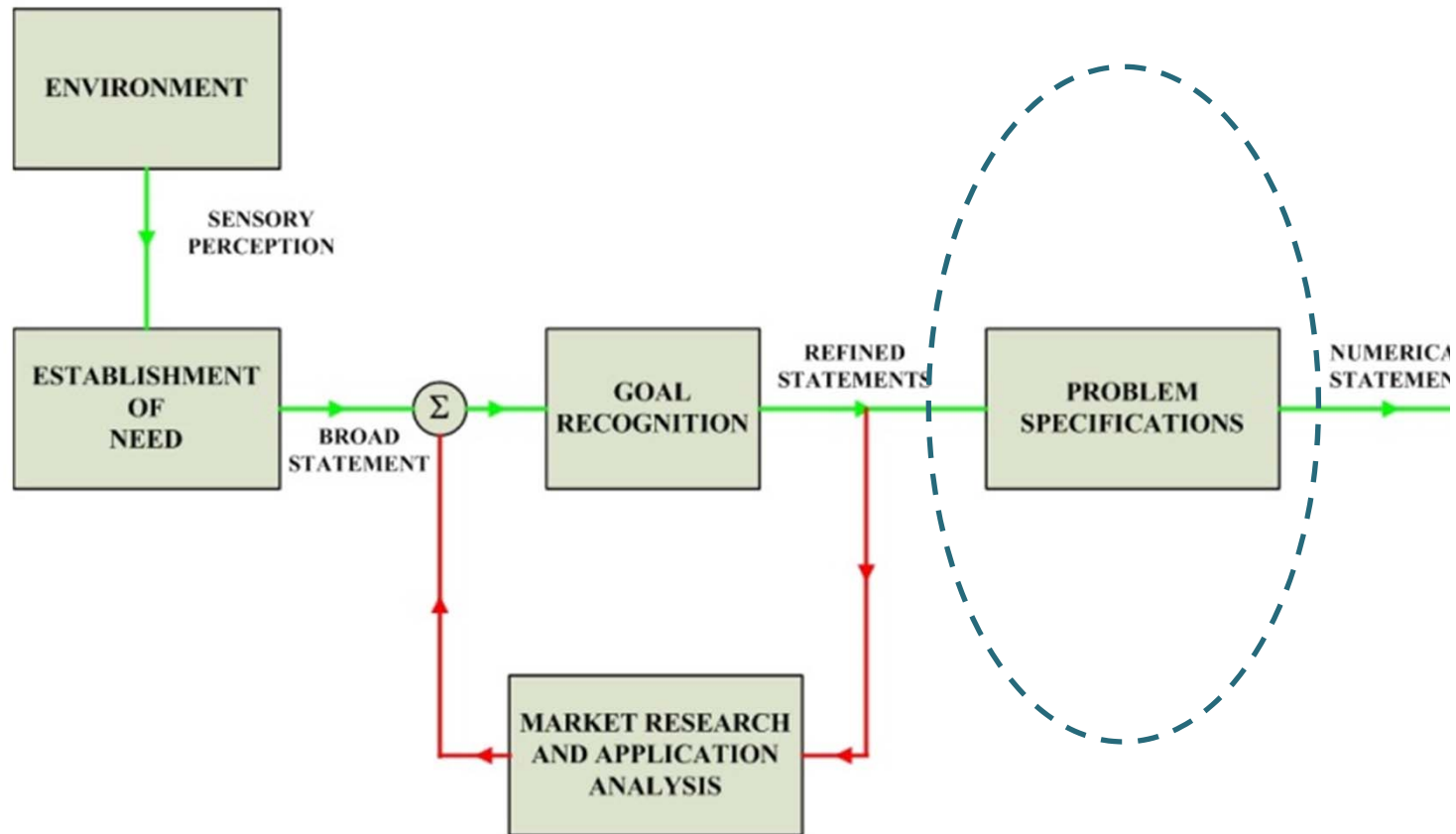


## Procedure:





## Problem Specifications (Initial Specification):



## List of items which may be required in Specifications:

1. Title of specifications.
2. Forward or introduction.
3. The role of equipment or material.

Nowadays  
(4 Steps)



MediRobot  
(2 Steps)



4. Related documents and references.



## **5. Condition in which the item is to be used, manufactured or stored**

- **Environmental features including for example temperature, humidity, pressure, shock, vibration, noise, dust, etc.**
- **Condition of use, power requirements, supply services,**
- **Servicing requirements.**

## **6. Characteristics:**

- **Samples, drawings, models, tests, etc**
- **Properties such as strength, dimensions, weight, safety, degree of purity.**
- **Interchange ability.**
- **Appearance, finish, color, protection.**

## **7. Performance:**

- **Performance under specified conditions.**
- **Test method and equipment for assessing performance.**

## **8. Life:**

- **Period of useful life.**
- **Total life.**
- **The method and equipment for assessing life.**

## **9. Reliability and control.**

## **10. Control of quality checking.**