



GE105  
Introduction to Engineering Design  
College of Engineering  
King Saud University

# An Overview of Engineering Design

2014-2015

## Importance of Engineering Design

- **70%** of a product's total cost (design, manufacturing and installation) is determined by its design
- Studies have shown that **50 to 80%** of the life cycle costs of products (maintenance, energy, etc.) are influenced by engineering design
- **Costs Include:**
  - Material costs
  - Facilities
  - Tooling
  - Labor
  - Other support costs



## What is Engineering Design?

- Engineering design is the **process** of devising a system, component or process to meet desired needs.
- In this process, basic sciences and engineering are applied to optimally convert resources to meet a stated objective.



- Among the fundamental blocks of this process are: **objectives, criteria, synthesis, analysis, construction, testing, and evaluation.**
- In addition to these blocks It is essential to consider realistic **constraints** such as economic factors, safety, reliability, aesthetics, ethics and social factors.

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## An ABET Requirement (Accreditation Board for Engineering and Technology)

- Every Engineering Department must include a major engineering design experience that builds upon the fundamental concepts of: mathematics, basic sciences, humanities, social sciences, engineering topics, and communication skills

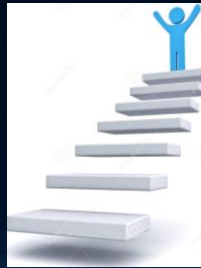
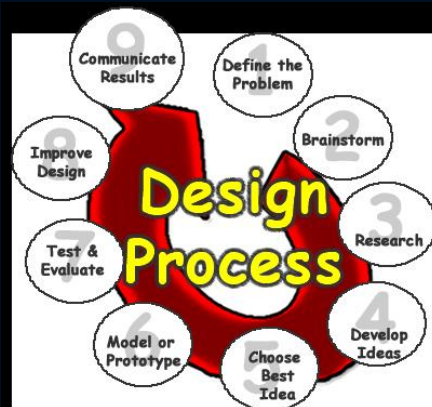


- The scope of the design experience within a program should match the requirements of practice within that discipline
- All design work should not be done in isolation by individual students; team efforts are encouraged where appropriate

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## The Design Process Steps

1. Define the Problem
2. Brainstorm for creative ideas
3. Search and re-search
4. Develop Ideas
5. Analyze alternative solutions and choose the best one



6. Model or prototype
7. Test and Evaluate
8. Improve if needed
9. Communicate results

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## Problem Statement

- This is the single most important step in the design process
- Only when you can specify the problem can you hope to achieve your goal
- Loss of efforts and efficiency occurs when trying to solve un-clear problems
- If this step is done incorrectly or incompletely it results in a failure of the design.
- It is important to define the true problem one is solving, not just the symptoms of the problem or the perceived problem.



## Objectives

- Objectives are a function of needs
- Objectives should be **SMART**  
 Specific  
 Measurable  
 Achievable  
 Realistic  
 Time-bounded

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## Step 1: Problem Statement

### Problem Statement:

"The current box is easily damaged during transportation"

### Objective

"Design a stronger box for our new product"

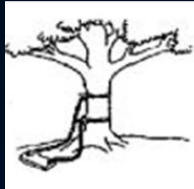
### Another Objective

"Design an improved box"

### Importance of Accurate objective and statement



Problem  
Definition



Design



Installation



Customer  
Need

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## Step 2: Brainstorming

- Think outside the box
- Generate creative ideas
- Explore other members' ideas
- Avoid criticism/judgment

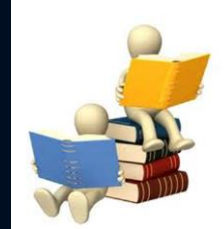
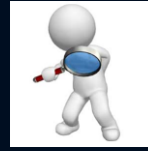
(do not criticize during brainstorming!  
Criticism will be applied at a later stage)



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### Step 3: Search and Research

- **Search:** for finding a product or checking the price of an item
- **Research:** finding the answers to more complicated questions or looking at multiple aspects of an issue
- Possible resources: Publications, Internet, Market, Patent listings, Sales catalogs, Experts



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### Step 4: List and Evaluate Alternative Solutions



One possible solution!!

- Be critical
- Edison: "It is easy to obtain 100 patents if you also have 5000 unsuccessful inventions"

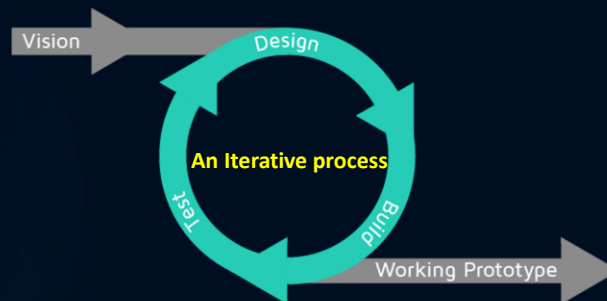
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## Step 5: Choose the Best Solution

	Weight	Rate for Design 1	Rate for Design 2	Rate for Design 3
Cost				
Production difficulty				
Size, weight, strength				
Appearance				
Convenience				
Safety				
Legal issues				
Reliability/durability				
Customer appeal				
<b>TOTAL points</b>	<b>100</b>	<b>points=rate*weight</b>		

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## Step 6: Construction, Analysis and Testing



## Step 7: Final Evaluation

Develop the best design



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## Step 8: Communication

Communicate and report on all the final details of the design through:

- Engineering Notebook (logbook)
- Written reports
- Technical presentation
- Training material, catalogue, manuals



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