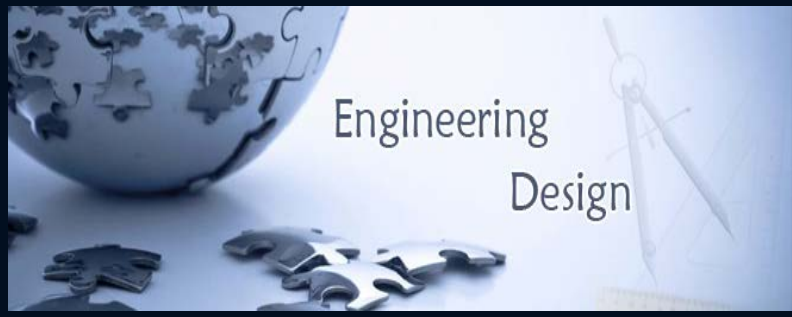

GE105
Introduction to Engineering Design
College of Engineering
King Saud University

# Lecture 2.
# An Overview of Engineering Design

JANUARY 2016

# 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

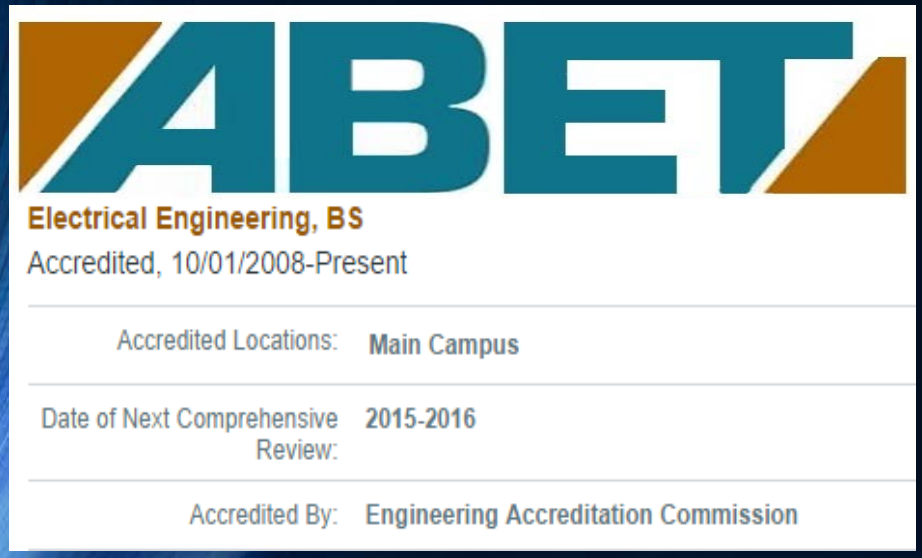
# What is Engineering Design?

- 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.

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

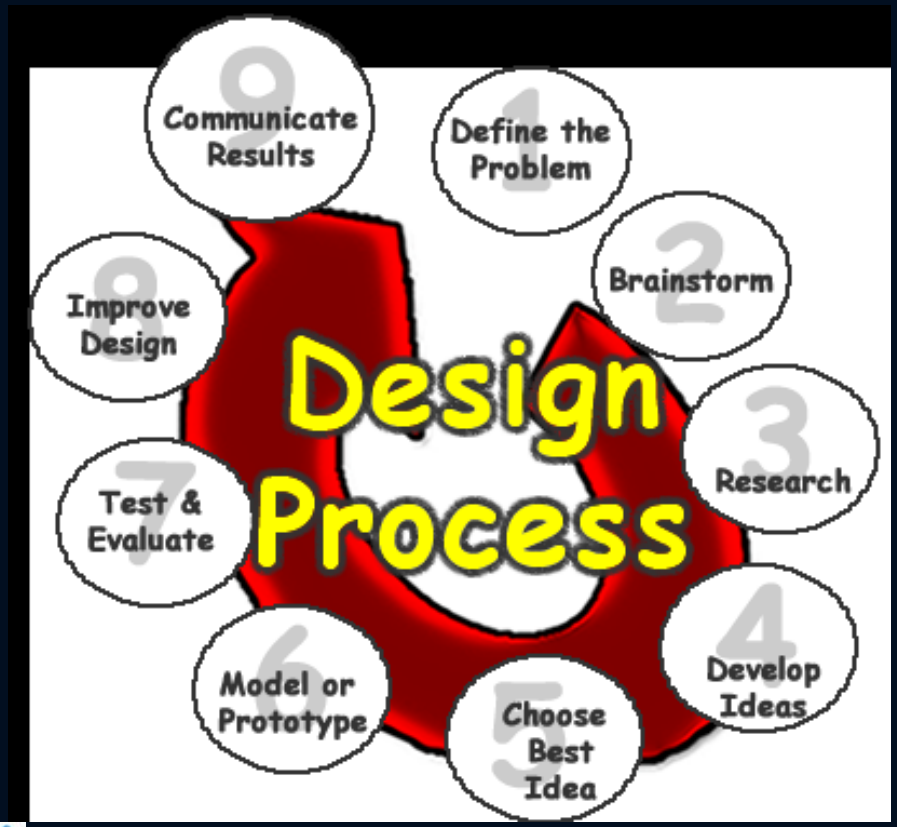
- Every Engineering Department must include a major engineering design experience that builds upon the fundamental concepts of: mathematics, basic sciences, humanities, social sciences, engineering topics, and communication skills

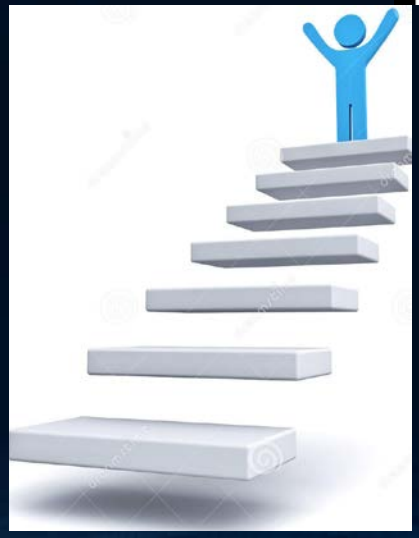



- The scope of the design experience within a program should match the requirements of practice within that discipline
- All design work should not be done in isolation by individual students; team efforts are encouraged where appropriate

# 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

# 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 unclear 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

# Step 1: Problem Statement

**Problem Statement:**
"The current box is easily damaged during transportation"

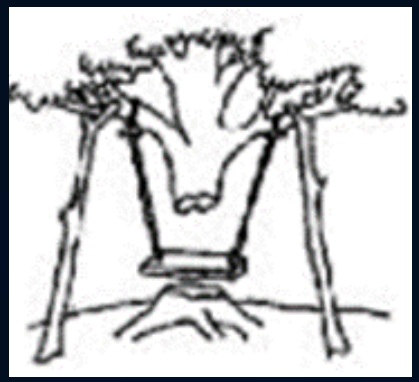
**Objective**
"Design a stronger box for our new product"

**Another Objective**
"Design an improved box"

**Importance of Accurate objective and statement**

Problem Definition

Design



Installation

Customer Need

# Step 2: Brainstorming

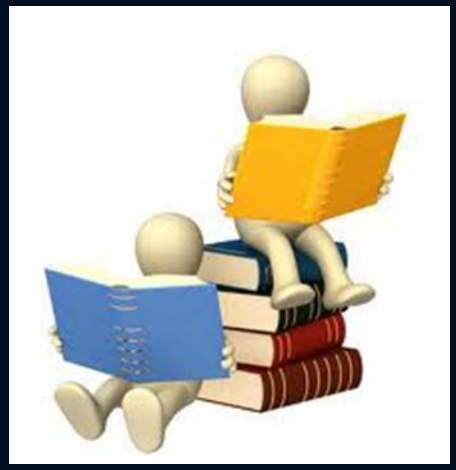
- Think outside the box
- Generate creative ideas
- Explore other members' ideas
- Avoid criticism/judgment

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

# 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



# Step 4: List and Evaluate Alternative Solutions

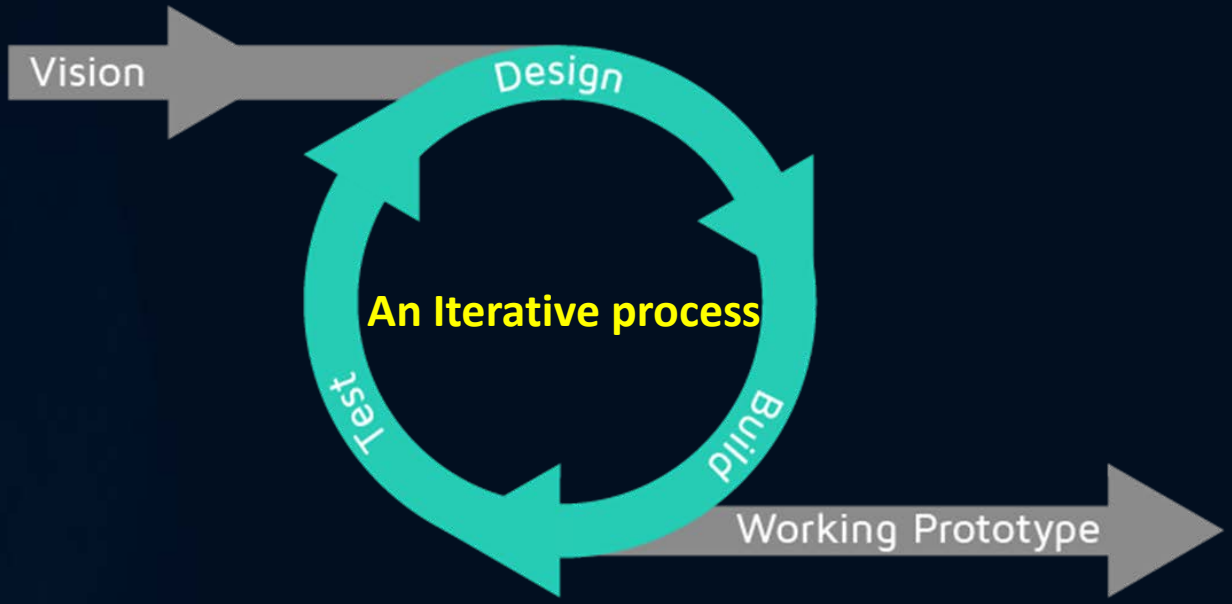
One possible solution!!

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

# 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 | | | | |
| TOTAL points | 100 | points=rate*weight | | |

# Step 6: Construction, Analysis and Testing




# Step 7: Final Evaluation

Develop the best design

# 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