Process of Design

Identification of roles
- Client: sets objectives for the designer
- User: sets requirements of the product
- Designer: develops specifications that can be built and satisfies everyone

• Engineering design is the organized, thoughtful development & testing of new objects that have a particular configuration or perform some desired function(s) to meet customer and client needs without violating any specified limitation.

• Successful designs meet or exceed the given specifications and satisfies or exceeds the clients expectations.

How to conduct organized thoughtful development and testing

Client Statement
- identify client needs; user requirements
- identify constraints; establish function

Conceptual Design
- Focus on high level issues with weak technical details; establish design specs.; generate alternatives
- Size or select subunits; back-of-the envelope calculations; evaluate; make final choice

Preliminary Design
- Design is left to component specialists; simulation, prototype, refine optimize
- Fabrication and documentation

Detailed Design

Final Design

Accomplishing the goals in each design step?

Client Statement (problem definition)

Means:
- Conduct a literature review
- Brainstorm
- User surveys etc

Output:
- Revised problem statement
- Detail and set weights to objectives
- List of constraints
- List of user requirements
- State function

Conceptual Design:

Means:
- Analogies
- Brainstorm
- Benchmarking
- Reverse engineering

Output:
- 3 to 5 conceptual design alternatives
- Design specifications

Preliminary Design:

Means:
- Simulation
- Proof of concept testing
- Prototype development
- Reverse engineering

Output:
- Select a single design from alternatives
- Create a single design from modifying alternatives into one
- Design matrix evaluation results

Detailed Design

Final Design
Accomplishing the goals in each design step?

**Detailed Design:**
- **Means:**
  - Formal design review
  - Design to code or national standards
  - Component specifications
  - CAD drawings
  - Beta testing, modification to optimize
- **Output:**
  - Fabrication specifications
  - Final design review in company

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**Final Design:**
- **Means:**
  - Verify that product meets user and client specification
  - Verify with production facilities that volume production is possible
- **Output:**
  - Final production
  - Final report to client

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**Example**

If I asked you to design a safe ladder, what questions come to mind? (Brainstorming)

1. How is the ladder to be used?
2. How high should someone on the ladder be able to reach?
3. How much weight should a safe ladder support?
4. Should the ladder be portable?
5. How does one define safe?
6. How much should it cost?
7. Will the ladder be made of wood, aluminum or fiberglass?
8. How many steps are there on the ladder?
9. How are the steps to be attached to the frame?

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**Group Dynamics**

**Conflict Resolution**

Groups under go 5 stages of development

1. Forming
2. Storming
3. Norming
4. Performing
5. Adjourning

**Forming**
- Becoming oriented to the task at hand
- Becoming acquainted with other members
- Testing behaviors to determine viewpoints and values
- Seeking out the person whom will be “in charge”
- Define some initial ground rules!

It is important to recognize that judgments made in the forming stage may prove to be invalid over the lifetime of the project.
Storming
- Resistance to task demands
- Interpersonal conflicts
- Venting of disagreement without resolution
- Struggle for group leadership

It is important to recognize when the team is spending too long in the storming phase and the team must encourage all team members to move on.

SEEK HELP FROM ADMINISTRATORS = DR. LAZ and DR. LENGSFELD

Norming
- Clarification of roles in the group
- Emergence of informal leadership
- Development of a consensus on group behavior
- Emergence of consensus on the group's activity and performance

It is important for members who want a successful outcome to recognize that simply ignoring unacceptable behavior or poor work products will not be productive.

Performing
- Clearly understood roles and tasks
- Well-defined norms that support the overall goals
- Sufficient interest and energy
- Emerging solutions and results

This is the point in the team development at which it becomes possible for the goals of the team to be fully realized.