

ENGINEERING DESIGN PROCESS

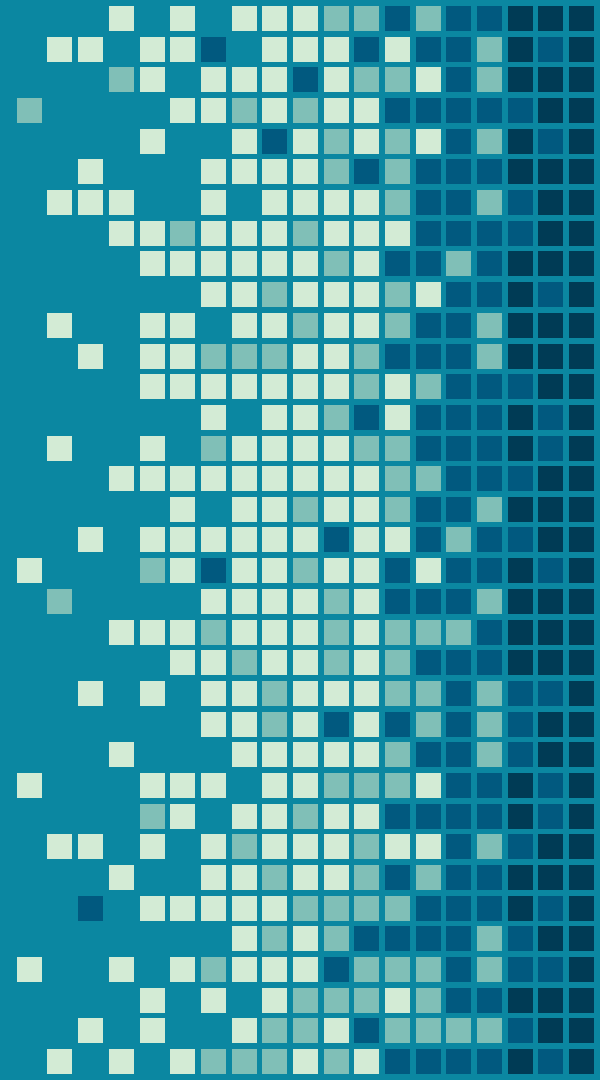
Adapted from Teach Engineering

Developed by University of Colorado Boulder

<https://www.teachengineering.org/k12engineering/designprocess>

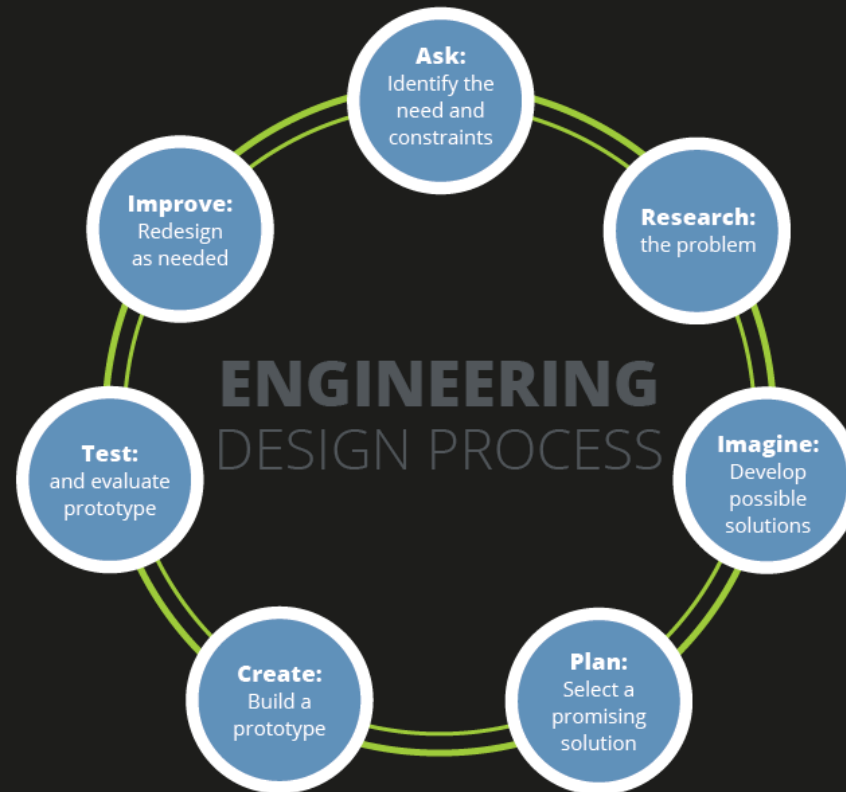
Michael D'Argenio – mjdargen@ncsu.edu

Electrical Engineering – SS 2019 – Duke TIP



Engineering Design Process

- The engineering design process is a series of steps that guides engineering teams to solve problems.
- The design process is iterative, meaning that we repeat the steps as many times as needed, making improvements along the way as we learn from failure and uncover new design possibilities to arrive at great solutions.



Ask: Identify the Need & Constraints

- Engineers ask critical questions about what they want to create, whether it be a skyscraper, amusement park ride, bicycle, or smartphone.
- These questions include:
 - What is the problem to solve?
 - Who is it for?
 - What do we want to accomplish?
 - What are the project requirements?
 - What are the limitations?
 - What is our goal?

Research: Understand the Problem

- Working WITH people, not FOR people.
 - Understand precisely what their needs are.
 - Make sure you are solving the correct problem.
- Investigate what products and solutions exist.
 - What did they do right?
 - What did they do wrong?
 - What already in existence can be leveraged?

Imagine: Develop Possible Solutions

- You work with a team to brainstorm ideas and develop as many solutions as possible.
- This is the time to encourage wild ideas and defer judgment! Build on the ideas of others! Stay focused on topic, and have one conversation at a time!
- Remember: good design is all about teamwork! Help students understand the brainstorming guidelines by using the TE handout and two sizes of classroom posters.

Brainstorming Rules

- One conversation at a time
- No bad ideas
- “Yes and ...”
- Make sure everyone can speak
- Document all ideas
- Quantity over quality – refine later
- Encourage wild ideas
- RESPECT

Anti-Problem Solving

- Another way of framing the problem to inspire new ideas.
- Come up with the worst possible ideas on how to do it.
- Can reveal some things that are very important to avoid.
- Example: How to design a grocery store.
 - Anti-problem solving: turn off the lights, hide everything.
 - Realization: It is important to have a well-lit grocery store where aisles are labeled and laid out methodically.
- Activity: Design the worst possible bathroom.

Plan: Select a Promising Solution

- For many teams this is the hardest step!
- Revisit the needs, constraints and research from the earlier steps, compare your best ideas, select one solution and make a plan to move forward with it.
- Lay out preliminary design on paper, assign roles, create project plan.

Create: Build a Prototype

- Building a prototype makes your ideas real!
- These early versions of the design solution help your team verify whether the design meets the original challenge objectives.
- Push yourself for creativity, imagination and excellence in design.

Test: Evaluate the Prototype

- Does it work?
- Does it solve the need?
- Communicate the results and get feedback.
- Analyze and talk about what works, what doesn't and what could be improved.

Improve: Redesign as Needed

- Discuss how you could improve your solution.
- Make revisions. Draw new designs.
- Iterate your design to make your product the best it can be.

Repeat, Repeat, Repeat!

