Engineering Design Handout

What is engineering?

Engineering builds upon math, physics, chemistry, biology and technology to solve problems and create new things. The ability *to design* is the hallmark of engineers. Design sets apart engineers from scientists as engineers move from general to specific ideas. Engineers apply the laws of nature (discovered by scientists) to create and build the devices, systems and structures that meet human needs.

What are some common types of engineering?

Aerospace engineers design rockets, airplanes, fuel-efficient cars and space vehicles.

Biomedical engineers work with physicians and biologists to apply engineering to medicine and human health; they design prostheses, medical devices, imaging systems and more.

Chemical engineers apply the principles of chemistry to the design of manufacturing and production systems to make chemical reactions happen on a large scale, as well as design all sorts of products.

Civil engineers design society's infrastructure: bridges, highways, buildings, water treatment plants, etc.

Computer engineers design computer networks, software systems, computer controlled devices, and more

Electrical engineers design using electricity, such as image processing, video, audio, fiber optics, data communication, etc.

Environmental engineers focus on water and air pollution, recycling, waste disposal, global warming, etc.

Mechanical engineers design physical structures involving motion: planes, bicycles, robots, body parts.

What is the engineering design process?

Design is an open-ended process in which more than one feasible solution may exist. Your goal is to come up with the *best possible solution* given the constraints (requirements and limitations) of the situation. Constraints may include cost, size, accuracy, safety and feasibility. Design differs from many other problem-solving tasks you have worked on in the past. In science classes, you solve problems or predict and confirm the results of experiments. In design problems, no single "right" answer exists.

Good vs. Not-So-Good Design Characteristics

Good Design	Not-So-Good Design
1. Meets all technical requirements	1. Meets only some technical requirements
2. Works all the time	2. Works initially, but stops working after a short time
3. Meets costs requirements	3. Costs more than it should
4. Requires little or no maintenance	4. Requires frequent maintenance
5. Is safe	5. Poses a hazard to users
6. Creates no ethical dilemmas	6. Raises ethical questions

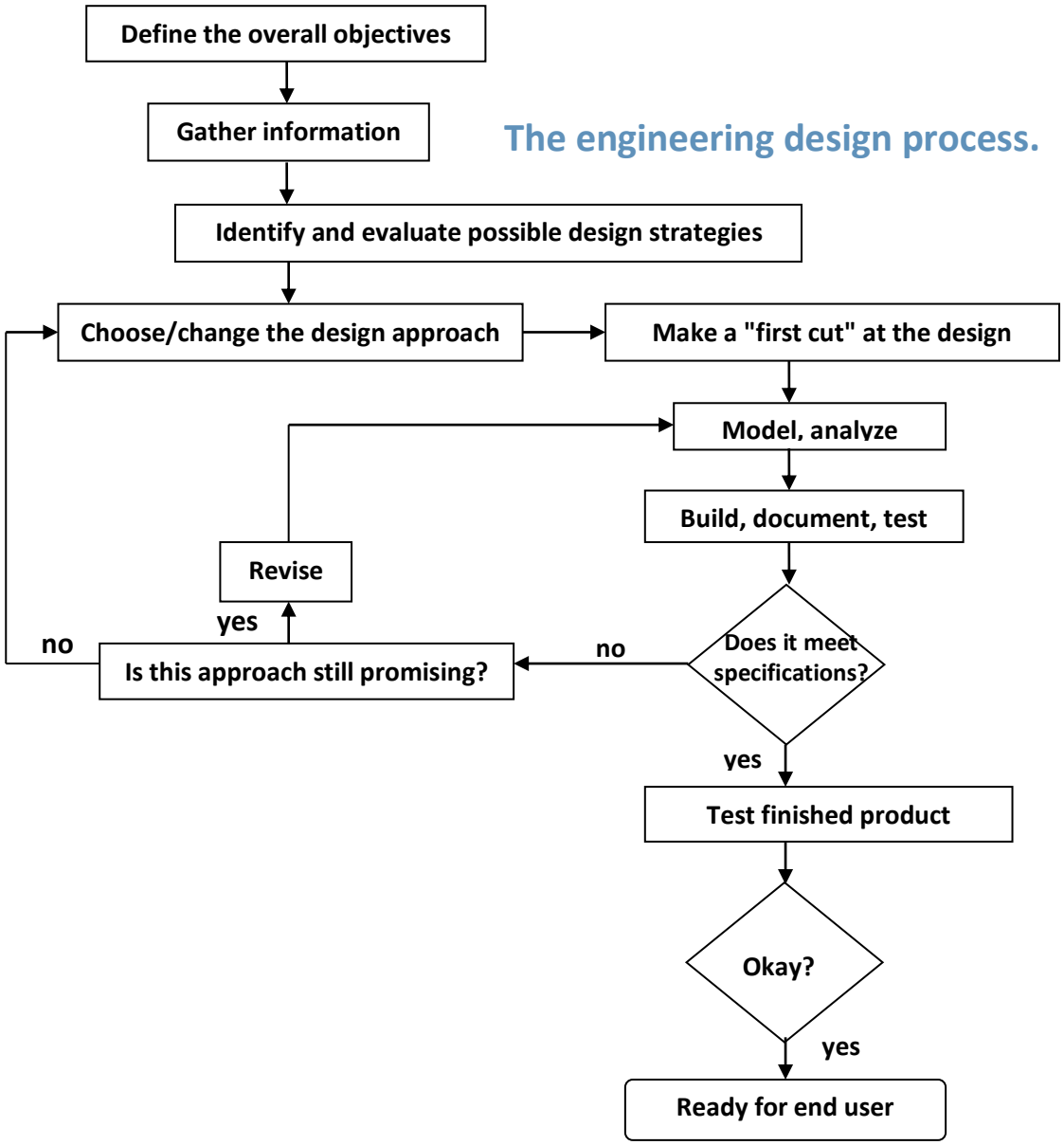
The Engineering Design Cycle

Design is a process—one that requires more than one iteration.

The following flowchart describes the cyclical process in a flow chart presentation.

As you define the objectives, consider the following questions:

- *Who will use the product?*
- *What risks are involved?*
- *What are the needs of the end user?*
- *What are the most critical features?*
- *What are the cost factors?*
- *What are the constraints?*



Primary source: Horenstein, Mark N. *Design Concepts for Engineers*. 4th edition. New York, NY: Prentice Hall, 2010.