Description of Design Considerations and Design Criteria

Examples of Design Considerations (NOT Design Criteria)

The following list has been created to assist the students with establishing appropriate design criteria. The best designs are often a compromise of multiple competing criteria. It is up to the engineer to make judgments weighing the costs and benefits of each decision. Discussion of these design considerations is required in the Design Proposal (ME 481) and Project Report (ME 482). *All of these should be considered when establishing criteria.* ***These are NOT criteria themselves,*** *these are design considerations:*

- Performance – How is the design to function? What need is it filling? What does it have to do? Is it reliable?
- Serviceability – Is maintenance or repair a concern? If so, can it be easily performed?
- Economic – Is the production and/or use costs considered?
- Environmental – Does this have positive or negative impact to the environment? Are there any environmental effects due to the production, use or end-of-use of the design? Are appropriate materials selected?
- Environmental Sustainability – *(Sustainability refers to the practice of having minimal impact on the environment. Completely sustainable practices do not deplete or degrade the environment.)* Does the design consider recycling, and using sustainable materials and manufacturing methods? Are renewable energy sources used (such as solar)? Does the product promote sustainable practices?
- Manufacturability – Can the design be economically produced? Can critical elements be inspected?
- Ethical – Has the student followed the code of ethics established by professional organizations such as ASME? Does the design benefit humanity? Have appropriate standards been applied? Are the design documents accurate with claims not overstated?
- Health and safety – Have appropriate codes and standards been applied to prevent harm? Does the design mitigate harmful effects of failure to prevent injury? Does the design directly improve the health and safety of users?
- Social – Does it benefit society? Are there societal implications of the product?
- Political – Are there political implications of the project? What materials or parts would need to be imported? Would this be exported or imported?

Completed criteria (sometimes referred to as *design specifications*) must clearly define the performance of the completed project. They should be sufficiently stated such that they could be given to an engineer unfamiliar with the project and that engineer could develop a successful design. The ***design considerations*** above should serve as a ***starting point for defining criteria*** on any project.

Establishing design criteria is often an iterative process. It can be approached by starting with "high level" descriptions (somewhat ambiguous) and then be refined to clarify purpose. Start by listing all criteria that may influence the design and define its success. The following tables provide examples of how to communicate design criteria for a project. Specific format is optional.

Table XX – lawn mower design criteria.

#	**Criteria**	**Priority**	**Description**
1	Safe to operate	Essential	Must meet all governing regulations and standards
2	Economical	High	Maximum unit production cost of $100, maximum development cost $100K
3	Portable	High	Weigh less than 40 pounds and be easily lifted
4	Easy to start and operate	High	Require no more than 20 pounds force to start (if using a manual starter system), should require no more than 10 pounds to push on flat level ground covered with 4 inch tall grass
5	Easily serviced	Medium	Routine service should possible with standard tools (screwdrivers, wrenches and hammers) and should be able to be performed by untrained users in 15 minutes
6	Cut the grass to lengths between 1.5 and 4.0 inches	Medium	With ½ inch adjustments

Once criteria have been established, multiple alternatives should be identified through brainstorming activity, literature search, etc. Viable alternatives should be evaluated and compared in order to down-select to the "best" option ("best" is sometimes difficult to define or identify). A table such as the following should be included when discussing down-selection.

Table XY – Evaluation of various designs

#	**Criteria**	Gas powered, manual start	Electric powered	Gas powered, electric starter
1	Safe	1	1	1
2	Economical	$100	$80	$170
3	Portable	2 (40lb.)	1 (25lb.)	3 (50lb.)
4	Easy to start and operate	3	2*	2
5	Easily serviced	2	1	3
6	Grass to lengths	1	1	1
	Selected	No	Yes	no

1 = Meets or exceeds criterion, 2 = meets criterion less well, 3 = does not meet criterion

Note that **all** of the advantages and disadvantages must be related to the criteria.