# Program Specific Project Requirements

## Product Realization/Mechanical Design Projects

Product realization and mechanical design projects need to **be more than simply producing a product prototype**. They should apply concepts gained from upper-division coursework.

The following are **the typical minimum requirements** for a product development/mechanical design project:

1) Working drawings for components

* Properly dimensioned & tolerance
  + GD&T
* Appropriate material specifications (refer to appropriate ASTM or other standards)
* Appropriate surface finish or coating specifications

2) Product realization pathway

* Start with a production estimate
* Identify production processes that would be used
* Identify any tooling would be required
  + Design the tools
* Prospective supplier list
  + Generate pricing data
* Either: A) Estimate capital required to begin production from scratch
  + What machines would need to be purchased?
  + How much would these machines cost?
* Or: B) Estimate capital required to begin production from existing enterprise.

3) An emphasis on design for manufacture

* The design must reflect a knowledge of manufacturing methods.
* Include break-even analysis of different production methods.
* Design around appropriate manufacturing methods.
* NOTE: 3D printing is rarely a feasible production method. Design for high production manufacturing processes such as these:
  + Extrusion
  + Molding
  + Casting
  + Machining (optimized, CNC)
  + Etc.

4) Include tooling & documentation required for prototype and/or production. Tool design often adds a more appropriate level of depth to a project. It is required for most of these types of projects. Tooling may or may not be constructed due to cost and time constraints, but it almost always should be designed.

* Design assembly fixtures
* Design welding fixtures
* Design molds (use the NX Mold Wizard)
* Design punches, dies and other die tooling
* Design die sets

5) Computer-aided manufacturing data (if applicable)

* CAD Model (if applicable)
* CAM (or developed software, e.g., spreadsheet)
* CNC Program
* Calculations of speeds and feeds
* Shop documentation

6) Prototype and or working mockup

* It is an excellent idea to include **process validation** where the tolerances applied to the design are statistically shown to be feasible. For example, product parts and calculate Cp, Cpk. Or compare Cp and Cpk achieved with alternative production methods.
* Use statistical methods to demonstrate an improvement of a method (ANOVA, etc).

7) Product Analysis and documentation

* Consider writing instruction manuals for your product
* Perform FEMA analysis of your design, make changes as appropriate.