

---

## Design for “X”

### Topic 10



---

## Today

- Get back CAD tutorials (if appropriate)
- Pot of Gold (due Friday after fall break)
- Preliminary schedule for post fall-break topics
  
- Review Course Objectives
- Preliminary comments on survey (hand in today to folder, TAs, Dr. P. or ME4000 basket)
  
- **Due** in class Friday 10/5 in class
  - HW#4 – Specifications
- **Due** in class Friday 10/5 in class or before
  - CAD tutorial 1
  
- Getting Assignments back after today
  - Folders to class or see TAs (possibly other)
  
- Design for Manufacturing



---

## Optional Topics

- **Monday 10/15**
  - FEA & Cosmos
- **Wednesday 10/17**
  - CFD and Fluent (Prof. Eric Pardyjak)
- **Friday 10/17**
  - Welding (Prof. Dave Hoepner)
- **Monday 10/22**
  - Composites (Prof. Dan Adams)
- **Wednesday 10/24**
  - Intellectual Property, Invention Disclosures, and Patents (Dr. Rajiv Kulkarni, TCO)
- **Friday 10/26**
  - Cosmos Motion (GoEngineer guest lecture)



---

## Review of Course Objectives

1. To learn the design process and apply it to team projects.
  - Textbook, lectures, in-class exercises, HW, CFP...
2. Work closely with team advisor to develop an engineered product (**mostly up to you**)
  - Take advantage of advisors experience (you will often rely on experts as a designer)
  - Learn to communicate effectively (memos, drawings, etc...)
  - Learn to take constructive criticism
3. Learn to effectively manage project resources (budget, project schedule, man power). (**text and HWs, but mostly up to you**)
  - Work effectively as a team
  - Learn to plan out, build, and evaluate project prototypes
4. Learn to efficiently document design work in real-time (design notebook, dig. Pictures, Wiki). (**brief example, mostly up to you**)
5. (Re)gain proficiency for basic CAD modelling (**tutorials**)



## Preliminary survey comments

- Pace & content
  - About right
  - Too slow
  - Stuff should be covered in previous semester
    - Used to be...
  - Feels like 3<sup>rd</sup> semester of ME1000
    - Bingo, it should
- The textbook
  - Book is mostly common sense
  - Good, but not worth the money...
  - "A very good choice"
  - Teaches how to be an effective engineer...
  - Wouldn't even read book if we didn't have quizzes
    - OK, so we'll probably have more quizzes next year, plus a midterm.
- TAs
  - Provides constructive comments
  - Doesn't seem interested in my project
    - Suggestions??



## Preliminary survey comments

- Assignments
  - Too much writing
    - ME4000 fulfills upper division communications and writing requirement
  - 3 drafts of executive summary too much
    - I'm sure your advisor disagrees
  - Quizzes are graded poorly
- In-class exercises and participation
  - Gets us thinking about aspects of project
  - 2-3 min. useless, 5-10 min. good
    - I agree and will shoot for 5+ min. in future
  - "Too much practice and hypothetical fluff"
  - I don't like being forced to come to class
    - I don't know another way to provide a better foundation for your projects
    - Suggestions???
- Your effort
  - Many said that they expect more of themselves



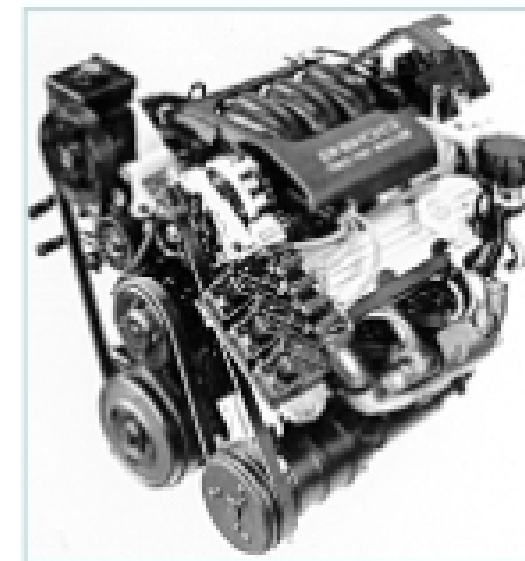
*Product Design and Development*  
Karl T. Ulrich and Steven D. Eppinger  
4th edition, McGraw-Hill, 2008.

### Chapter Table of Contents

1. Introduction
2. Development Processes and Organizations
3. Product Planning
4. Identifying Customer Needs
5. Product Specifications
6. Concept Generation
7. Concept Selection
8. Concept Testing
9. Product Architecture
10. Industrial Design
11. Design for Manufacturing
12. Prototyping
13. Product Development Economics
14. Managing Projects



## Design for Manufacturing Example: GM 3.8-liter V6 Engine



## Definition

- **Design for manufacturing (DFM)** is a development practice emphasizing manufacturing issues throughout the product development process.
- Successful DFM results in lower production cost without sacrificing product quality.

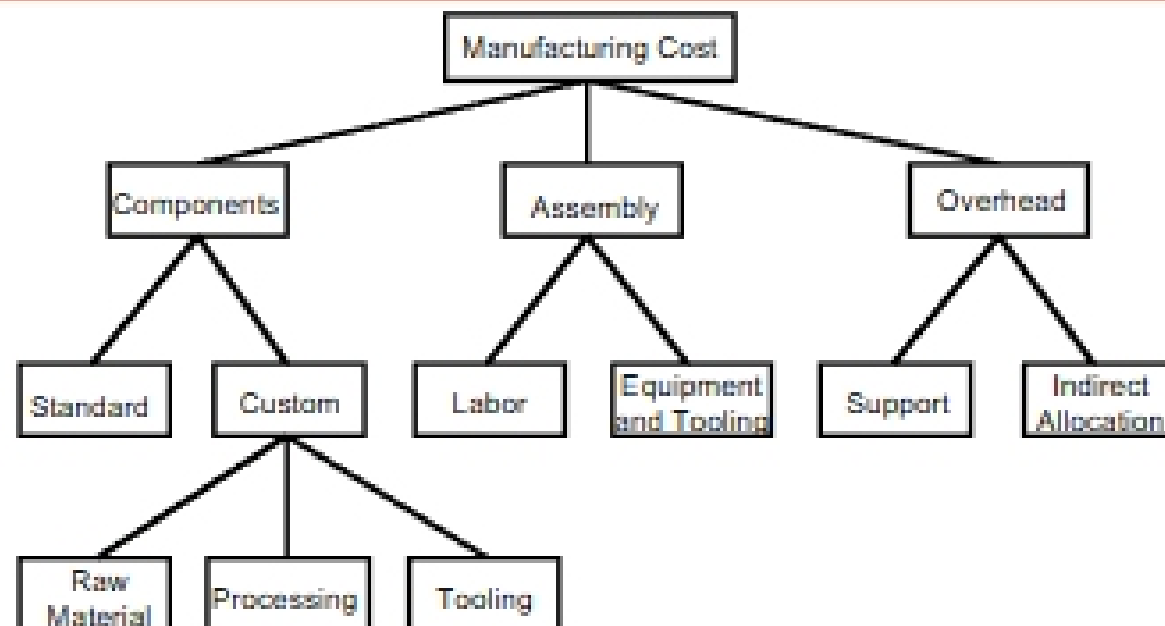


## Overview of DFM Process

- Note similar guidelines can be applied to other Design for “X”
1. Estimate the manufacturing cost
  2. Reduce the cost of components
  3. Reduce the cost of assemblies
  4. Reduce the cost of supporting assemblies
  5. Consider the impact of DFM decisions on other factors



## Understanding Manufacturing Costs



## Estimate Manufacturing Costs

- **Component costs**
  - BOM
  - Standard vs. custom components
- **Assembly costs**
  - Related to number of parts
- **Overhead costs**
  - Keep the lights on, security, admins., etc...
- **Fixed vs. variable costs**

