

# 2.008 Design & Manufacturing II

Spring 2004

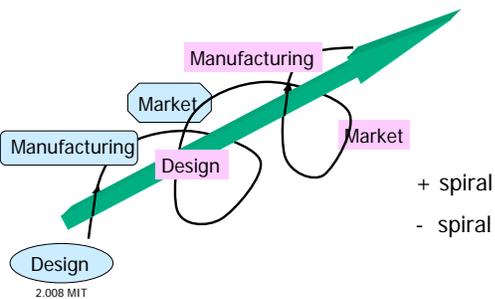
## Course Information

## 2.008 Staffs

- Faculty
  - Professor Sang-Gook Kim, Wed 4-6
  - Professor Jung-Hoon Chun
- Lab Instructors
  - David Dow
  - Patrick McAtamney
- TAs (office hours on Mon, Tue, 5-6)
- Course Administrator

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## Manufacturing Chain



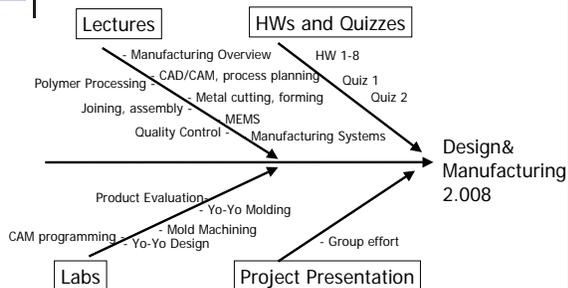
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## Positioning of 2.008

- |                       |                        |
|-----------------------|------------------------|
| ■ 2.007               | ■ 2.009                |
| ■ Elementary          | ■ Capstone             |
| ■ Small scale         | ■ Large scale          |
| ■ Individual          | ■ Team                 |
| ■ Boxful of scraps    | ■ \$6,000 per team     |
| ■ What did you learn? | ■ What will you learn? |

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## 2.008 Fishbone Chart



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## Scope

- Lectures and labs
  - Manufacturing processes
  - Equipments/control
  - Manufacturing systems
  - Design for manufacturing
- Rate, cost, quality and flexibility

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## Lectures

- Monday, Wednesday, 12:30 to 1:55 PM

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## References

- TEXT →
- Manufacturing Engineering and Technology, 4<sup>th</sup> ed. by S. Kalpakjian and S. Schmid (Prentice Hall, 2001).- TS176.k34 **R**
  - Manufacturing: Design, Production, Automation and Integration, by B. Benhabib, Marcel Dekker, New York, 2003
  - Axiomatic Design, by Nam P. Suh, Oxford Press, 2001 – TS171.4.S84
  - An Introduction to Microelectromechanical Systems Engineering, by Nadim Maluf, Artech House 2000 – TK7875.M35 **R**
  - CAD/CAM/CAE systems, by K.W. Lee, Addison-Wesley, 1999
  - Principles of Polymer Processing, by Z. Tadmor and C. Gogos, John Wiley & Sons, 1979 – TP1087.T32 **R**

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## Safety

- Safety!
- Safety!
- Safety!

Safety Instructions By David Dow

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### 2.008 Lab Safety Policy

#### SAFETY GLASSES MUST BE WORN AT ALL TIMES !!

- Follow all safety procedures of the instructors.
- Long hair *must* be tied back.
- Appropriate clothing *must* always be worn:
  - No open shoes, sandals or rollerblades.
  - No baggy or loose clothing (including ties).
  - No loose jewelry or jewelry on fingers and hands.
- NO* running in lab.
- Be Aware* of what is happening around you.
- Never EVER* operate a machine which you haven't been taught to operate.
- When in doubt, *ALWAYS ASK* for help.
- And once again, safety glasses *MUST* be worn at *ALL* times.

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## Laboratories

- Safety first
- Lab
- Lab sections, M2-5, T9-12, T2-5, W2-5, R9-12, R2-5, Max 12 students per section (2 groups each section)
- Section allocation today, lab grouping on the web by Monday morning 10AM.
- Mandatory lab attendance
  - Grade (30% +  $\alpha$ ) from lab reports, attendance, group meeting minutes

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## Lab section sign up

- Want to stay as pre-registered, stay.
- Want to change your lab sections, come and take the 3M sticker with your name on.
- Priority to Seniors to change sections.
- General changes.

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## 2.008 Labs

- Lab I: CAD/CAM/Process Plan I
- Lab II: CAD/CAM/Process Plan II
- Lab III: CAD/CAM/Process Plan III
- Lab IV: Yo-Yo Manufacturing: Part Design
- Lab V: Yo-Yo: Tooling Design
- Lab VI: Yo-Yo: Tooling Fabrication
- Lab VII: Yo-Yo: Parts Production
- Lab VIII: Yo-Yo: Variation
- Lab IX: Manufacturing Systems: Lego

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## Group meetings

- Team effort for Yo-Yo mfg and the final presentation
- Discuss design decisions, part dimensions, and report preparation outside lab once a week.
- Keep minutes and submit with each report.
- No peer reviews.

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## Project Presentation

- Group Presentations
- Final presentations
  - on May 10<sup>th</sup> 12:30 – 3:30 with pizza or
  - at class hours of May 10<sup>th</sup> and 12<sup>th</sup>
- Topics, your Yo-Yo Manufacturing Case

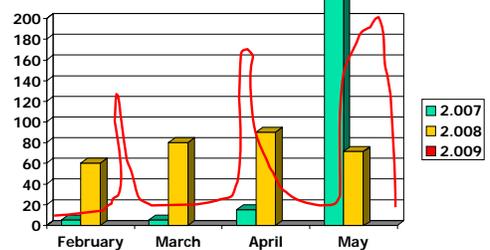
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## Credit and workload

- 12-unit subject (3-5-4)
  - 3 hours of lecture
  - 5 hours of laboratory, group meetings and preparation
  - 4 hours of study, hw

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## Workload distribution



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## Grading

- Quizzes (two) 40%
- Lab performance and reports 30%
- Participation & Project presentation 20%
- Home Works 10%

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## Plant tour

- Plant tour to a manufacturing facility (TBA) on April 21(W), 22(Th), 2-5PM.
- Attend either one of two. Sign-up to Mr. Dave Dow for your preference by April 2<sup>nd</sup> 4PM.
- Safety reminder; proper attire, safety glasses, shoes

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## Restaurant Owner

- Have customers eat well
- Customers serviced well
  - speed
  - customization
- Affordable tab
- \$\$\$ - profit

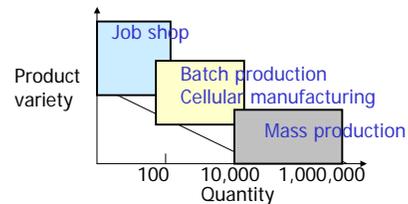


LaVerde Sub shop vs Chinese Truck

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## Discrete Manufacturing

- Low production; 1 to 100 per year
- Medium production; 100 to 10,000
- High production; over 10,000 units/yr



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## Mission

- How to satisfy human need and create wealth
- Product to meet the customers' requirements
  - Quality, flexibility
  - Cost, rate
- Acquire trust and confidence for intelligent decisions

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## Manufacturing Industry

- \$4 Trillion, shipments, 1997
  - 1997 Economic Census, U.S. Census Bureau
  - Whole Sale \$4 T, Retail \$2.5 T
- 459 SIC industries (NAICS)

<http://libraries.mit.edu/guides/courses/spring2004/2.008/>

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## Manufacturing Industries

- The transition from an agrarian society of the 1700s to an industrial society of 1900s resulted in the industrialization of agriculture and not its disappearance.
- Today, only 3% of Americans are engaged in agricultural activities in contrast to 90% of the workforce in the 1700s.

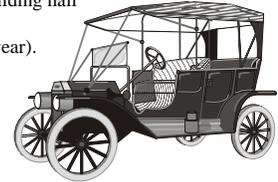
	U.S.A		Japan		Germany		Canada	
	1930	1999	1930	1990	1933	1990	1931	1990
Agriculture	22.9	2.9	49.9	6.9	2.9	3.5	35.2	4.3
Manufacturing	24.5	18.0	16.1	23.4	31.6	31.6	16.4	15.7

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## Automotive Manufacturing Industry (cont.)

- The Ford Motor Co. has been the most studied and documented car manufacturing enterprise.
- The 1909 Model T car was easy to operate and maintain.
- By 1920, Ford was building half the cars in the world (more than 500K per year).



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## Objectives

- Exposure to key manufacturing processes
- Understand the measure of success or failure of processes, machines or systems
- Apply physics to control the measure; **cost, rate, quality, flexibility**

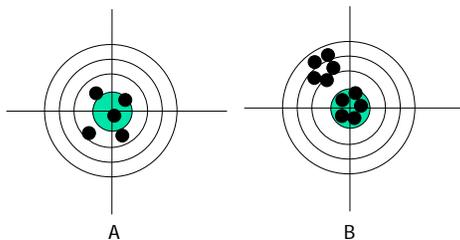
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## Objectives (cont.)

- Understanding of variation of the manufacturing processes and systems
- Control of processes and systems with the presence of variation
  - SONY TV
  - Mercedes, BMW
  - Six sigma – 3.4 defects per million

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## Shooting Contest



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## Objectives (cont.)

- Manufacturing constraints on product design and process planning
- Learn manufacturing system issues
  - A system has many different units in its boundary.
  - What is a complex system?
  - What is a good system?

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## Future

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- Information Technology (digital)
- Globalization
- New Manufacturing Technology
- New Materials

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