Introduction to Manufacturing
Outline

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• Intro to manufacturing
Contact Details

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  – Off. Hrs.: Fridays 4-5 p.m.
  – Also by appointment
  – Class website:
    http://www.me.iitb.ac.in/~ramesh/ME338/
Focus and Objectives of Course

- Learn the fundamentals of machining, optimization, non-conventional machining, fixturing and metrology
- Develop first order mathematical descriptions for select processes to analyze and calculate important quantities for the unit processes e.g., forces, power, time, final shape, etc.
- Develop an understanding of the capabilities and limitations of the unit processes in terms of quality and productivity
- Emphasis on understanding the physical principles underlying these processes
- Apply this knowledge to manufacturing process selection, part design for manufacture and quality control.
- Encourage teamwork and group activity via group assignments and Project.
Introductory Remarks

• See second page of syllabus
  – Homework
  – Exams
  – Honor code
  – No cellphones on the desk !!!!
    • In silent mode in your bag/pocket
Grading Policy

- Group Assignments in self-selected groups of 4 or less: 10%
- Quizzes: 10%
- Midterm: 25%
- Term Project: 15%
- End semester exam: 40%
- Total: 100%
Definition

- **What is Manufacturing?**
  - derived from the Latin word *manufactus*
  - *manus* = hand, *factus* = made
  - practical definition: *process of converting or processing raw materials into usable products.*
What is Materials Processing?

• Imparting changes in material:
  – Geometry
  – Material properties:
    • Strength
    • Hardness
    • Toughness
    • Etc.
Systems-Oriented Definition

• Manufacturing as a system or enterprise
  – “A series of interrelated activities and operations involving design, materials selection, planning, production, quality assurance, management, and marketing of discrete consumer and durable goods” (CAM-I)

  – a highly complex, interdependent activity that is dynamic in nature.
Design - Materials - Process Relationship

• Product design, materials selection, and materials processing are highly interrelated.

• For example:
  – weight reduction --> thin cross-sections --> mfg. problems
  – tight tolerance specs. --> specialized/high precision processes required --> increased cost
  – aluminum vs. steel beverage cans --> different metal forming needs.
Coke Cans over the Years

0.66 oz. (18.8 g) in 60’s, 0.48 oz (13.5 g) in 90’s
Classification of Unit Manufacturing Processes

- Based on:
  - process type e.g., shaping vs. non-shaping
  - state of workpiece material e.g., solid or liquid
  - processing energy e.g., mechanical, electrical, …
Classification of Unit Manufacturing Processes

- **Shaping process classification**
  - Mass conserving, $dM \sim 0$
    - examples: casting, bulk forming, powder processing
  - Mass reducing, $dM < 0$
    - examples: conventional and unconventional machining
  - Mass adding, $dM > 0$
    - examples: joining processes

Further sub-classification is possible based on processing energy and workpiece state considerations
Casting  \( (dM \sim 0) \)

Forging  \( (dM \sim 0) \)

Cutting  \( (dM < 0) \)

Welding  \( (dM > 0) \)
Summary

• Focus on:
  – Physical principles and analysis of process
  – Process Capabilities

• Teamwork will be encouraged
  – Homework
  – Term Paper