

- Instructor:** Mr. David Bothman, bothman@engineering.ucsb.edu, 2109 Engineering II, x 4125
- TA:** Kevin Crider, kevincrider@umail.ucsb.edu
- Goal:** The goal of ME12 is to provide an overview of common manufacturing processes important in mechanical engineering. Students will learn to identify the processes used to make common products and understand why those processes were selected.
- Lecture:** Tuesday, 3:30 - 4:45, South Hall 1430
- Labs:** Optional labs will give students the opportunity to take apart interesting machines in order to figure out how they work and how they were made. The schedule will be announced in class.
- Office Hours:** Monday 2-3:30, or by arrangement.
- Homework:** Homework will consist of preparing a summary sheet for each of the processes discussed in class. Homework will be due at the beginning of class.
- Exams:** There will be brief in-class quizzes. The process notebook will be a compilation of the summary sheets mentioned above.
- Grading:** 40% quizzes, 30% homework, 30% process notebook (compilation of homework). Extra points awarded for submission of additional excellent on-line manufacturing references and videos (only first person to submit a particular reference will be awarded points for that reference). References will be posted on course web site.
- Text:** There will be no text for the class. The good texts are too expensive for the amount that we would use them in a one unit class. Several good manufacturing processes books are on reserve in the RBR, and additional copies are available in the stacks. We will use several on-line manufacturing references. I recommend purchasing a used copy of *Manufacturing Engineering and Technology*, Kalpakjian and Schmid if you are interested in manufacturing and would like a good reference book.
- Videos:** Video tapes showing industrial-scale manufacturing processes will be shown in class.
- References:** <http://bmi.berkeley.edu/Me221/mas2/html/processes/index.html>  
<http://class.et.byu.edu/mfg130/processes/index.html>  
[http://blog.nam.org/archives/coolstuffbeingmadecom\\_weekend\\_video/](http://blog.nam.org/archives/coolstuffbeingmadecom_weekend_video/)  
[http://www.ouellet.com/documents/upload/OUELLET\\_ANGLAIS\\_HI.wmv](http://www.ouellet.com/documents/upload/OUELLET_ANGLAIS_HI.wmv)  
<http://manufacturing.stanford.edu/>  
<http://www.doitpoms.ac.uk/tlplib/metal-forming-2/index.php>  
Wikipedia  
Encyclopedia Britannica

**Schedule:**

Date	Topics	Homework
1-April	Introduction / Casting	Sand casting
8-April	Casting / Materials	Die casting, Investment casting
<b>15-April</b>	<b>Forging / Rolling</b>	<b>Hot forging, rolling, wire drawing</b>
22-April	Presswork	Blanking, punching, drawing
29-April	Extrusion / Machining	Forward & reverse extrusion, machining
<b>6-May</b>	<b>Plastics</b>	<b>Injection molding, compression molding</b>
13-May	Plastics	Rotational molding, blow molding, extrusion
20-May	Non-traditional processes	EDM, wire EDM, rapid prototyping
<b>27-May</b>	<b>Joining</b>	<b>Welding, brazing, soldering, fasteners</b>
3-June	MEMS / Surface finishing	Painting, plating, spray coating, heat treatment
10-June		<b>Process notebooks due</b>

Note: Quiz dates shown in bold

## Processes that we will cover this quarter

<b>Metal Casting</b>	Sand casting Evaporating pattern casting Investment casting Die casting
<b>Metal Forging</b>	Hot forging Rolling hot/cold
<b>Metal extrusion</b>	Forward extrusion, reverse extrusion
<b>Plastic processing</b>	Compression molding Injection molding Rotational molding Blow molding Extrusion Vacuum molding
<b>Surface finishing</b>	Electroplating Painting Spray coatings
<b>Joining</b>	Bolts & Screws Welding - arc Welding - TIG Welding - MIG Brazing Soldering Laser welding E-beam welding Adhesives
<b>Presswork</b>	Blanking Punching Drawing rolling
<b>Machining</b>	Drilling Milling Turning Grinding
<b>Other topics</b>	Rapid Prototyping EDM Wire EDM MEMS / Integrated circuits

1. Brief description of the process.
2. Unique features of the process. When to recommend (or not recommend) the process.
3. List of the materials that are commonly used with the process.
4. Batch size for which this process is best suited.
5. Cost of parts produced.
6. Sketch of the process with the key steps and elements labeled.
7. Examples of parts made using the process.
8. **Note all sources!!!**

**Example:**

Process: Wire EDM

Description: Electric Discharge Machining, EDM, is a process in which a high voltage AC current is passed through an electrode. Sparks between the electrode and grounded workpiece cause the workpiece to melt. The electrode must be very close to the workpiece in order for this to work, and a dielectric fluid, often water, is used to facilitate sparking and to carry debris away.

With wire EDM the electrode is a thin wire (usually about .005 inches) that is moved through the workpiece like a very fine saw. Computer controlled motors can move the wire in complex trajectories.

Unique properties: The ability to cut very hard and difficult to machine metals. Complex shapes can be cut automatically. The thin kerf of the wire allows nearly sharp internal corners to be cut, unlike milling. Best suited for tooling or small runs of unique parts.

Materials: Wire EDM is suitable for any conductive workpiece. Unlike other cutting processes the hardness of the workpiece is not important.

Batch size/ cost: EDM is a slow process capable of making only one part at a time. As a result, parts produced this way are fairly expensive compared to mass production techniques.

Other information: very good accuracy, good surface finish, can be automated.

Example parts: extrusion dies, metal specimens for tensile testing, punch and die sets.

<http://class.et.byu.edu/mfg130/processes/descriptions/thermalreduction/edmwirecutting.htm>



Process diagram and example parts: [www.basiccarbide.com/picture.htm](http://www.basiccarbide.com/picture.htm), [www.componenteng.com](http://www.componenteng.com), [www.alltechprecision.com](http://www.alltechprecision.com)

**Homework #1: Read about and prepare summary sheets for sand, investment and die casting (one page each). Due at the beginning of class 4-8-08. Find at least one real part (not pictures on the internet) for each of the processes. Make simple sketches of the parts. If you have trouble look at a car, bicycle or take a trip to a good hardware store to find parts.**