INTRODUCTION
OBJECTIVES

LEARN TO SAFELY USE STANDARD MANUFACTURING TOOLS

BAND SAW
HAND TOOLS
DRILL PRESS
LATHE
MILL
CNC

GAIN INTUITION FOR THE PROTOTYPING PROCESS

METROLOGY
DRAWINGS
MATERIAL SELECTION
FASTENERS
TOLERANCES
OPERATIONAL SEQUENCES
20 individual parts = 1 big project

Grading is based upon:
Dimensions and tolerances
Finish quality
Punctuality

Other considerations:
Shop safety
Participation
Helping others
The Shop

Never work alone

Safety glasses and closed-toed shoes must be worn at all times

No jewelry, baggy clothes, or loose long hair

Upon arrival, you need to sign in with the on-duty TA

If you are unsure about something, ask for help

If something (a tool, machine, etc.) breaks, let us know

You must clean up after yourself

Before leaving, get your machine(s) checked off and do a “shop job”
MEAM150 - Fundamentals of Mechanical Prototyping

MEAM 150 provides students with an immersive, hands-on education in the prototype development process. This includes layout, measurement, part generation, milling, turning, computer-controlled machining, and many other manufacturing processes. Through the construction of a semester-long project, students gain proficiency in the skills necessary to successfully prototype a variety of mechanical systems.

Stirling Engine Project

The current semester schedule and a complete set of engineering drawings for this project can be found here.

Wall of Champions

At the conclusion of the project, we test each student's engine using a small butane table torch. The fastest engines from each semester are listed below:

- Summer 2008 (08B) - Jamie Gewirtz, 1605 RPM
- Fall 2009 (09A) - Andrew McGrath, 1396 RPM

HTTP://ALLIANCE.SEAS.UPENN.EDU/~MEDESIGN/WIKI
**Fundamentals**

**Geometry**
Show the shape of the object

**Dimensions**
Provide relative lengths of features

**Tolerances**
Give allowable variations for each of the dimensions

**Notes**
Scale, material, finish, post processing

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**Displacer rod fork**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DWG. NO.</th>
<th>REV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13</td>
<td>D</td>
</tr>
</tbody>
</table>

Scale: 4:1  
Sheet 1 of 1

**Notes**

UNLESS OTHERWISE SPECIFIED:

- Dimensions are in inches
- Tolerances:
  - Angular: Maximum 1/8
  - Bend: Two place decimal
  - Three place decimal
  - Four place decimal
  - Fractional: 1/64

- Interpret geometric tolerancing per:

**Material**

1/4" Sq C360 Brass

**Finish**

Lathe/Mill

**Application**

DO NOT SCALE DRAWING

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Geometry

Show all relevant sides of the part
Standard Projections

U.S. custom - “third angle projection”
(object rolling in a bowl)
Dimensions & Tolerances
Tolerances

Real parts are never exactly like the drawing...

(3x) Equally Spaced
4-40 UNC Thru .190 wall on 1.344 dia B.C.

SECTION A-A
SCALE 2:1

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGULAR: MACH ± 1  BEND ±
TWO PLACE DECIMAL  ± .01
THREE PLACE DECIMAL  ± .005
FOUR PLACE DECIMAL  ± .0005
FRACTIONAL  ± 1/64

INTERPRET GEOMETRIC TOLERANCING PER:

Heat Sink

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DIMENSIONS & TOLERANCES

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/64
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ± .01
THREE PLACE DECIMAL ± .005
FOUR PLACE DECIMAL ± .0005

BILATERAL

0.376 +0.001

-0.000

UNILATERAL

0.376 +0.001