CAD & Additive Manufacturing

Design your own Keychains, and learn about 3D printings Practical uses!

Madison McDonald, Graham Ballantyne April 2025

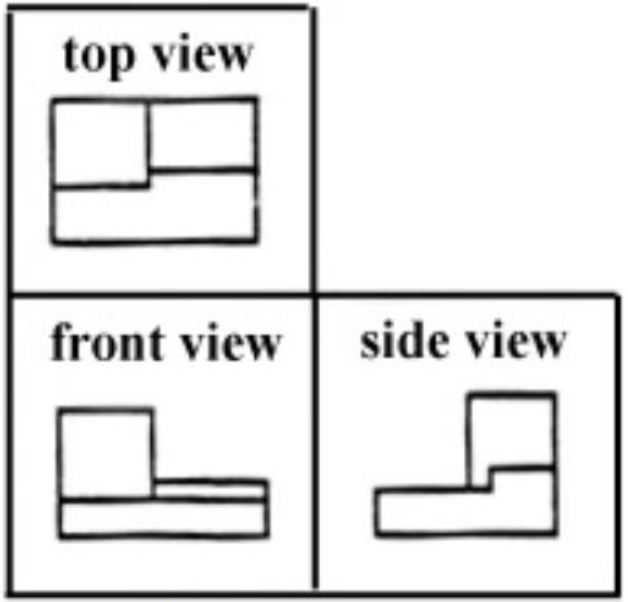
Intro to CAD

- Computer Aided Design
  - Modeling
  - Simulation
- Almost everything today is made in CAD before production
  - Allows for one to see what something will look like with dimensions before being made

Parts of CAD

- Sketch
  - Where parts are designed, and made 3D by extruding
- Assembly
  - Put all pieces from your sketch together through mating
    - Motion Studies to see how parts move together
- Drawings
  - Detailed technical drawings which allow for parts to be manufactured

Sketch



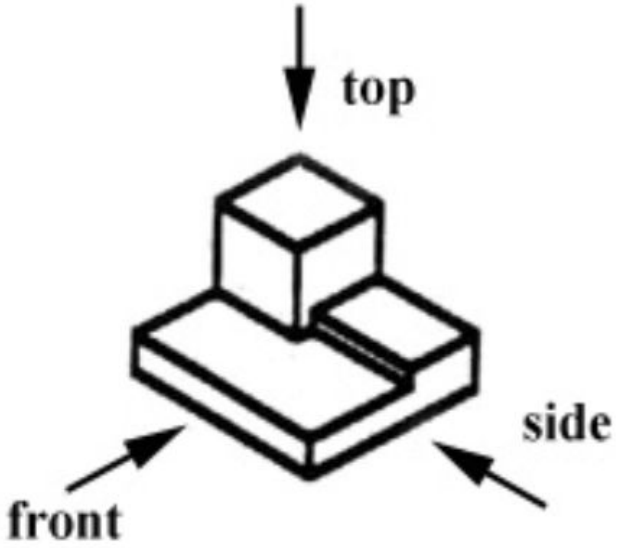
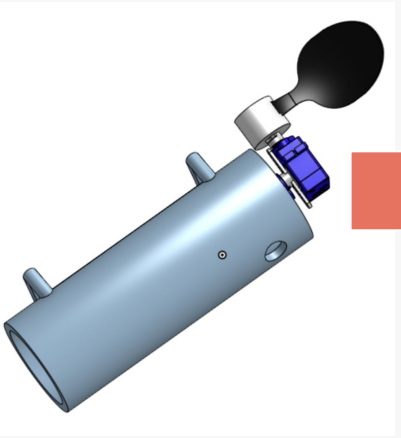
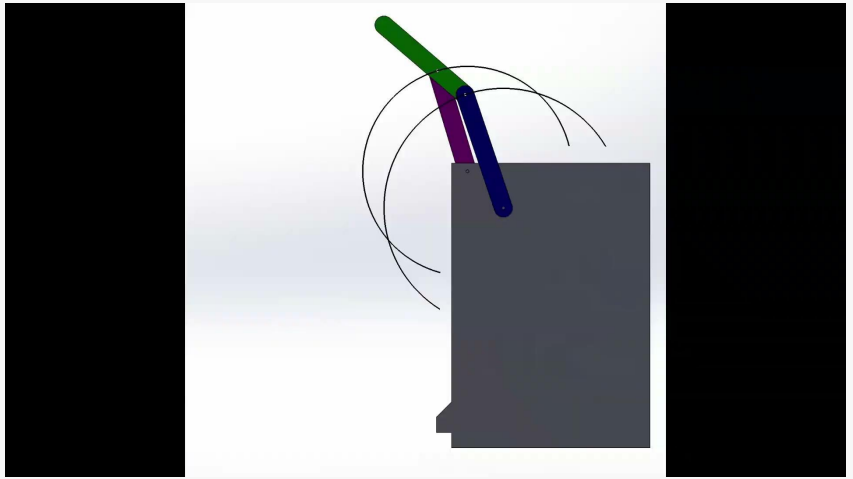


Figure 5 - A multiview drawing and its explanation.

Image sourced from: MIT Design and Manufacturing 2 spring 2009 Design Handbook: Engineering Drawing and Sketching | Design and Manufacturing I | Mechanical Engineering | MIT OpenCourseWare

Assembly + Motion Study





Drawings

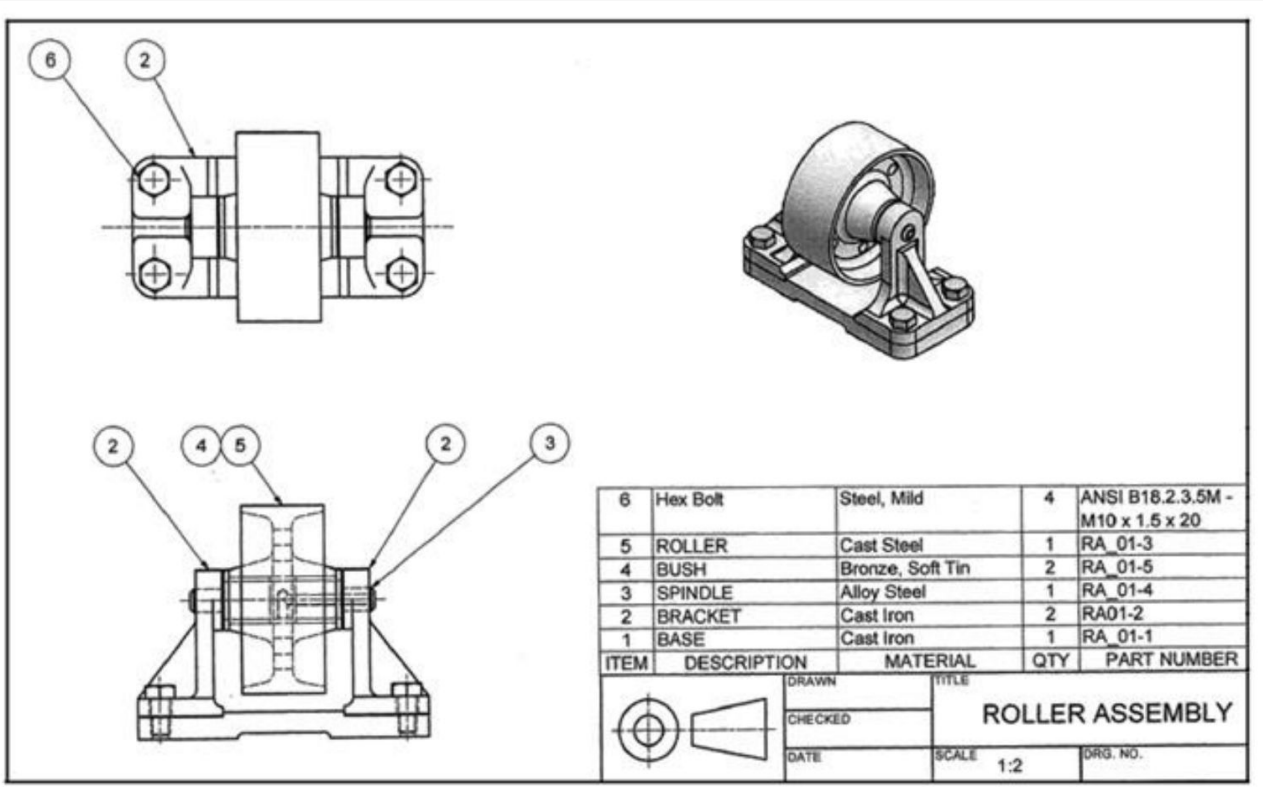


Image sourced from: NASA Engineering Working Drawings Basics Engineering+Working+Drawing+Basics.pdf

Drawings

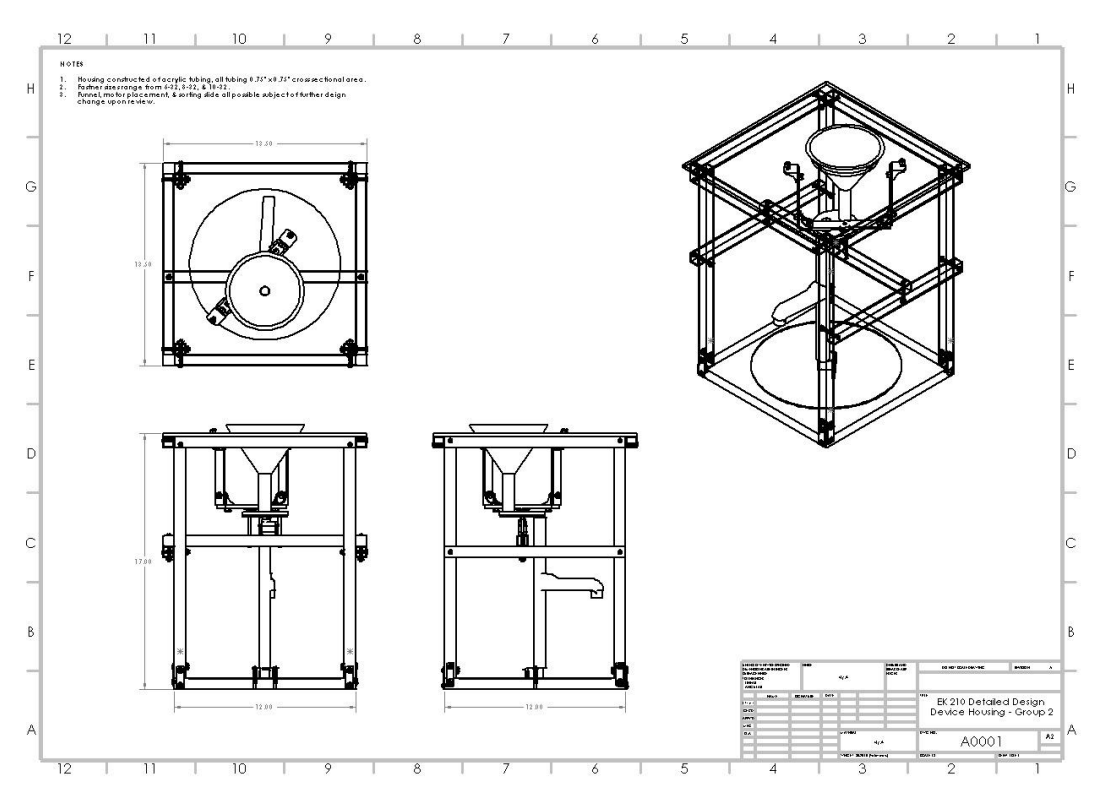
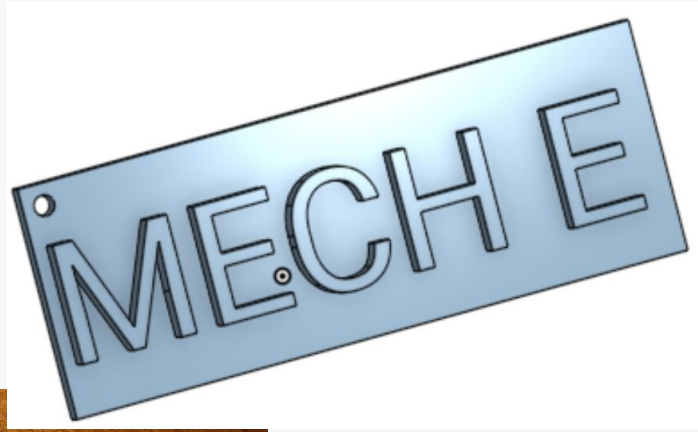


Image Source: Graham's EK 210 Color Sorting Device Housing Prototype

CAD Platforms

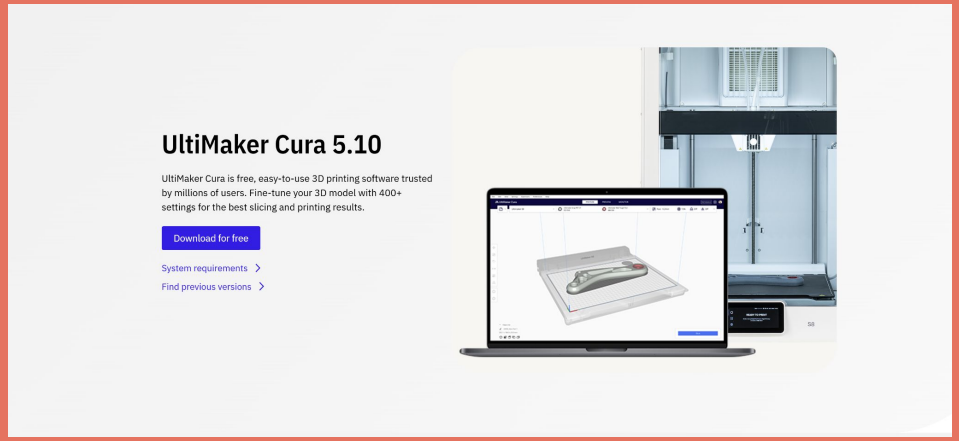
- Many different platforms
- Most work similarly, some more common in specific industries
  - Solidworks
  - Onshape
    - Cloud based
    - Free accounts, but everything you made is public
    - Owned by PTC
      - COE does undergrad site visits to PTC
  - Creo
  - Autodesk Inventor

Onshape Tutorial



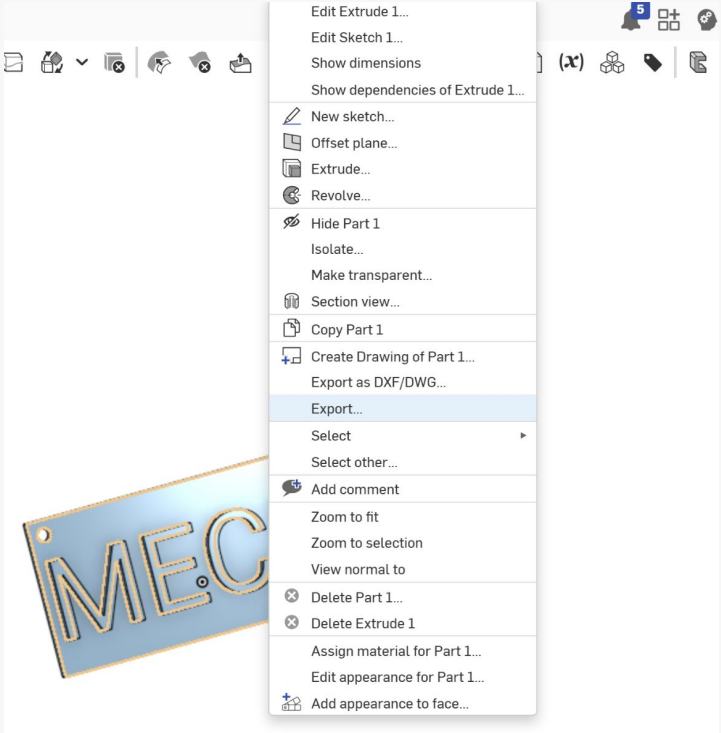
How to Request a Print at EPIC

1.) Download Ultimaker Cura (Free Slicing Software)



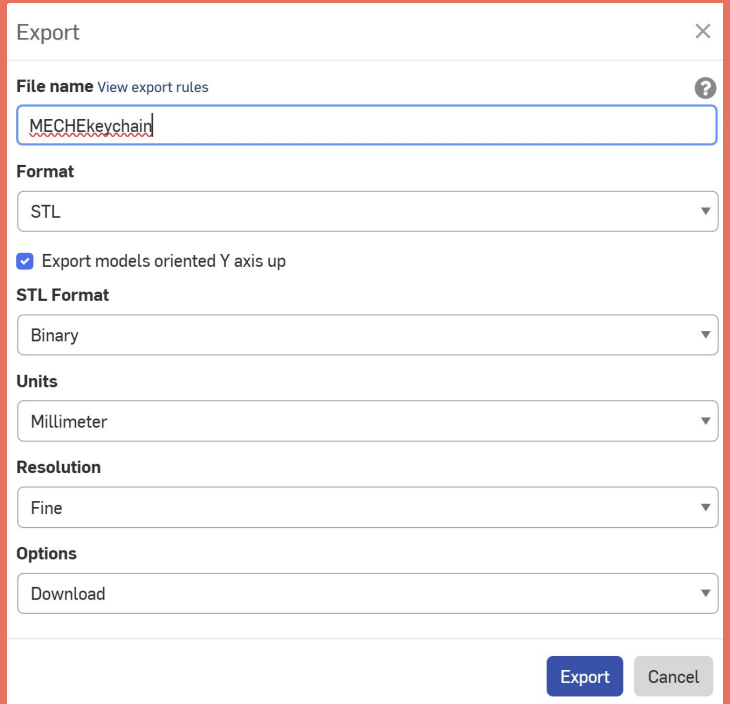
How to Request a Print at EPIC

2.) Right Click on the piece you created in onshape, and click export



How to Request a Print at EPIC

3.) Once in export tab, make sure you are exporting as an STL file!!! With these settings (even if you made your drawing in inches, export it in millimeters as this is what Cura reads in, dimensions will remain intact but will be read in mm instead of inches)



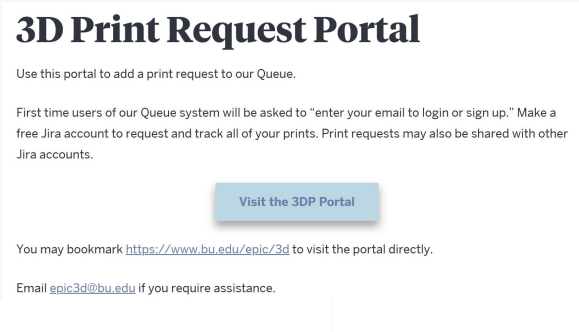
How to Request a Print at EPIC

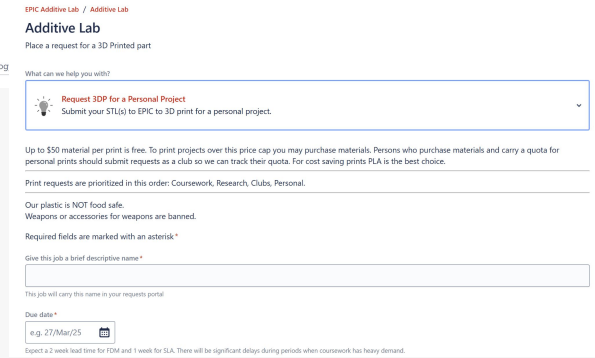
4.) Go to BU EPIC website and find the: 3D Print Request Portal

5.) Click “Request 3DP for a Personal Project

6.) Fill out questions about the print and

7.) All done! You will get a confirmation email from EPIC, when it is ready to be picked up!





Where else to print on campus?

- EPIC* also has a first come first serve 3D printing station (750 Comm. Ave)
- RASTIC (730 Comm. Ave)
- SiLab* (44 Cummington Mall)
  - Resin printing

*If you want to ENTER Silab and EPIC you must complete online safety training, can still use EPIC online additive queue without safety training.

Additive Manufacturing (3D Printing)

- One of most common forms of manufacturing is often called “subtractive manufacturing”
  - Drilling
  - CNC operations
  - Blank and die
- End goal is to make a part a certain shape/dimensions to meet manufacturing specifications or achieve goals
- Some other ways to make a part a desired shape include
  - Casting
  - Forging
    - Forming
    - Rolling
- 3D printing creates a piece without any of these “traditional” methods

Other Types of Additive Manufacturing

- Still under 3D-printing umbrella
  - Stereolithography
    - UV laser hits bed of photopolymer resin, bed moves up/down depending on printer
  - Selective Laser melting (SLM)
    - Strong laser hits bed of metal powder to create shape

Why “additive”?

- You are adding material to make a shape!
- Most common form of 3D printing
  - Extruder heats up and moves around with a preprogrammed “gcode” depositing filament layer by layer
- There are many different materials that can be 3D printed
  - Wood
  - Metal
  - Resins
  - Humans tissues
  - Lots of varieties of plastic
    - PLA
    - ABS
    - Nylon

What is it actually used for?

- Modeling
  - Highly detailed medical models
  - Architecture
- Prototyping
- Functional builds
- Custom parts
- Medical uses
  - Customized prosthetics
  - Bioprinting
  - Goal to print organs
- Print affordable houses
- Parts that have extremely complex shapes that wouldn’t be able to/make sense to be made through traditional methods


ASME
WHATS IN YOUR LAB?


ART
INSIDER

Questions?

Thank you!