

→ EDU Curriculum Guide



# → Personal and Project Management

## Prescribed Learning Outcomes

*It is expected the students will:*

- Be able to read a requirements sheet and translate this into a working drawing for the design phase
- Identify the materials needed and the feasibility of engraving/cutting this material
- Be able to estimate the time and materials needed to produce a job from the requirements sheet
- Produce a sketch with dimensions of the final outcome
- Be able to produce folders and files in a way that helps find the jobs later
- Identify thickness of material for the design phase

## Suggested Instructional Strategies

- Provide the students with a "customers' requirements" page that outlines what the customer needs in full detail. This could be in the form of a paragraph or bullet points.
- The students will be asked to quote time and material needed as well as a basic sketch of the project with dimensions
- Suggest students write out a bill of materials needed for the project
- Have students come up with a schedule for laser time
- Have students write up some processes that the laser engraver/cutter has replaced and how it made the process better
- Make a box with them using the Rhaulbotics box program to show how material thickness affects model

## Suggested Assignment Strategies

- Write out five or six potential customer requests from 3D pieces to 2D signs and hand them randomly to groups to learn to work as a pre-design team. Once completed, assess their ability to come up with a bill of materials, a sketch of the piece, the dimensions, and the accuracy of the completed project
- Inspect each groups folder structure for saved jobs (company name/job name/file name) for the bill of materials, time estimation, and sketch
- In the early stages of the group project, assess the student's ability to work as a team, cooperate with differing opinions, make use of time. Have them assess their own work in a 5-point scale
- Have them answer some questions like: If a material is this thick, how thick should our tab be?

## Recommended Learning Resources

Rahulbotics box maker program  
<http://boxmaker.connectionlab.org/>

Designing A box in Inkscape  
<https://www.youtube.com/watch?v=A1FI5Eq4PQ>

Quoting a job with a laser  
<http://www.sawmillcreek.org/showthread.php?179651-Laser-Cutting-Quote>



# → Science and History



## Prescribed Learning Outcomes

*It is expected the students will:*

- Know how a Co2 laser tube works
- Know who invented the laser
- Know the different types of lasers used in the industry
- Know the wavelength of the common laser types



## Suggested Instructional Strategies

- A brief talk about the inventor of the Co2 laser and some dates of their milestones
- Show the different kinds of lasers
- Show a video on how the Co2 laser works



## Suggested Assignment Strategies

- Multiple choice questions to assess understanding of the history and science for the laser

## Project Ideas



*Trophies and awards*



*Wood/metal combinations*



*Electronics engraving*



*Glass engravings*

## Recommended Learning Resources

Co2 laser works

[http://en.wikipedia.org/wiki/Carbon\\_dioxide\\_laser](http://en.wikipedia.org/wiki/Carbon_dioxide_laser)

Different types of lasers

[http://en.wikipedia.org/wiki/List\\_of\\_laser\\_types](http://en.wikipedia.org/wiki/List_of_laser_types)



# → Materials



## Prescribed Learning Outcomes

*It is expected the students will:*

- Learn to discern different types of plastics
- The difference between cast and extruded acrylic
- To judge ratios of speed and power for different materials
- Learn the difference between materials that can and cannot be cut
- Learn what is an unsafe material



## Suggested Instructional Strategies

- In Commander, use the speed and power settings provided to cut and engrave a cross section of a material
- Mark some cast and extruded acrylics with the same power settings
- Scratch-and-sniff some vinyl, ABS, and acrylic to notice the different smells
- Try cutting plastic, wood, stone and metal, to establish each materials cutability
- Talk about how super-heated vinyl releases chlorine gas that mixes with moisture to make hydrochloric acid gas



## Suggested Assignment Strategies

- Write up a "lab" report to have the class write their hypothesis
- Have the class write up what happened in each case and keep the paper in their laser book. This will be helpful for when they are making up their projects
- Test on what materials are cuttable, dangerous, toxic and flammable

## Recommended Learning Resources

Trotec's job control program settings

Acrylic types

[http://www.pmma.dk/Acryl\\_stobt\\_kontra\\_ekstruderet.aspx?Lang=en-GB](http://www.pmma.dk/Acryl_stobt_kontra_ekstruderet.aspx?Lang=en-GB)

Lasing PVC

<http://www.bofa.co.uk/lasingPVC.asp>

Engraving materials

<http://www.troteclaser.com/en-US/Materials/Pages/Material-Overview.aspx>



## → Supporting Tools



### Prescribed Learning Outcomes

*It is expected the students will:*

- Learn to use digital calipers
- Learn to use paper mask for cutting and engraving
- Be able to identify marks on a ruler
- Identify what materials need magnets to hold down
- Be able to use tape to hold down material



### Suggested Instructional Strategies

- Show each supporting tool on the bench and describe each one
- Show how masking can help aid in engraving and cutting
- Describe proper use of digital calipers
- Perform a job on veneer. This wood will need to be gauged with the calipers, coated with mask and held down by a magnet to the bed or taped



### Suggested Assignment Strategies

- See how groups of students do with using the calipers to measure several pieces of material. Both in inches and mm
- The same groups have to successfully apply mask to some wood
- These same groups mark out several lines using mm, cm, and inches

### Project Ideas



Writing utensils



Phone engraving



Jewelry



Coffee cups

### Recommended Learning Resources

Using digital calipers

[http://tresnainstrument.com/how\\_to\\_use\\_digital\\_calipers.html](http://tresnainstrument.com/how_to_use_digital_calipers.html)

[https://www.youtube.com/watch?v=Ceuh691Me\\_M](https://www.youtube.com/watch?v=Ceuh691Me_M)

Applying paper mask

<https://www.youtube.com/watch?v=WSgPJZuVd3U>



# → Laser Operation



## Prescribed Learning Outcomes

*It is expected the students will:*

- Know how to turn on and off the laser system properly
- How to check and clean the lens of the machine properly
- Know how to manually and automatically focus the machine
- know what to do in an emergency (fire, collision, hand-stuck)
- What to keep clean throughout the day



## Suggested Instructional Strategies

- In groups, show students the proper sequence to turn on and off the machine, clean the lens and focus the machine
- Show the proper procedure for fire, collision, or a hand being stuck
- Clean the machine with each group



## Suggested Assignment Strategies

- While following a checklist guide (that students will keep in their laser handbook), each student will go through the proper steps to make sure the proper readiness for engraving is reached
- Pop-quiz each student for an emergency and what to do in each case

## Project Ideas



*Paper greeting card*



*Architectural models*



*Clothing designs*



*Electronics engraving*

## Recommended Learning Resources

Trotec's Operation Guide

<http://www.troteclaser.com/en-US/Support/Documents/Speedy-300-Manual-EN.pdf>

Trotec's Job Control software guide

<http://www.troteclaser.com/en-US/Support/Documents/JobControl-Manual-EN.pdf>



# → Graphic Essentials



## Prescribed Learning Outcomes

*It is expected the students will:*

- Know how to set up their software for laser cutting/engraving
- Know to differentiate cutting tool paths with engraving lines
- How to set up their page for engraving on the right size laser bed
- What colours to use for different lasing operations



## Suggested Instructional Strategies

- Show lines on a page that are .003 (Hairline) and thicker lines, show the laser cut one and engrave another
- Show a small (4x4) page being cut on the larger bed
- Show an example of the most used software and how it is set up for engraving
- Describe why RGB colours must be used for lasers to know the difference in the objects, and apply different properties to each
- Make some objects on a (laser bed) size sheet and show how you can move your objects around to cut while using that size, instead of laser piece size



## Suggested Assignment Strategies

- From the Personal and Project Management section, have each of the groups produce their drawing on the screen using your preferred graphics software. Have each group practice the Hairline Cut / Thick Line Engrave technique
- Make sure each team uses 3 different engraving techniques

## Project Ideas



*Acrylic ornaments*



*Shelving units*



*Promotional items*



*Photo frames*

## Recommended Learning Resources

Trotec's Rayjet Commander software guide

Trotec's Rayjet user guide



# Health and Safety

## **Prescribed Learning Outcomes**

*It is expected the students will:*

- Identify and understand Worksafe regulations for laser classes
- Understand the interlock system
- Identify the moving parts and when to stay clear
- Understand the potential dangers of lasers (burns, fires, materials, exhaust)

## **Suggested Instructional Strategies**

- Health and safety training should always be taught first in the curriculum
- Engage in a discussion about the potential effects of a laser engraver on health
- Provide students with the Worksafe official laser-class designations
  - Discuss where one would find each class of laser
  - Explain the laser class of your laser and how it might be changed if safety is not followed
- Provide some photos of laser burns to demonstrate the need for proper safety
- Talk about the gasses involved in the cutting/engraving process
  - Talk about flammability, breathability and need for proper exhaust at all times
  - Show the class how to read a MSDS sheet and where to look for laser engravability

## **Suggested Assignment Strategies**

- Use Multiple-choice questions to assess the student's knowledge of the Worksafe regulations, laser safety systems, danger areas, and potential hazards
- Put students into groups and have each group describe a material from an MSDS sheet and whether it is Laser friendly
- Have students write out a paragraph on a made-up accident (learned from that class) and how it could have been prevented

## **Recommended Learning Resources**

Laser cutting PVC

<http://www.bclaserworks.com/pdf/lasercutpvc.pdf>

How to find MSDS Sheets

<http://www.ilpi.com/msds/>

Industrial Lasers can cause serious eye injuries and severe burns

[http://www.worksafebc.com/publications/high\\_resolution\\_publications/assets/pdf/laser\\_light\\_ws0607.pdf](http://www.worksafebc.com/publications/high_resolution_publications/assets/pdf/laser_light_ws0607.pdf)

Trotec Laser Safety

<http://www.troteclaser.com/en-US-US/About-Trotec/News/Pages/2013-04-Laser-Safety.aspx>

Trotec Exhaust

<http://www.troteclaser.com/en-US/Laser-Machines/Accessories/Exhaust-Systems/Pages/Exhaust-Systems.aspx>

