

## APPENDIX A

### Description of Modules

CAD (all online)	This module is a pre-requisite for all other modules. It will provide students an introduction to 3D modeling using a CAD (computer-aided design) software—OnShape—that will be relevant for the use of other prototyping and machining tools. Students will be able to use this knowledge to independently explore other CAD programs (i.e. SolidWorks) and their applications.
Blue Permit	This module is a pre-requisite for all other modules. (Students who have already obtained a Blue, Red, or Green Permit in the past will not repeat this module.) The blue permit is the lowest level permit available. The permit requires minimal training and correspondingly, grants minimal access to tools and equipment within the College of Engineering.
Laser Cutting	The laser cutting module will introduce you to processing material with a laser. You will learn how to design files and run the laser cutter. You will also learn how to use a strip heater to bend acrylic.
3D Printing	This module will introduce you to important concepts for 3D printing. Tutorials will include FDM and SLA printing.
Intro to Electronics	This module will introduce you to the basics of electricity and electronics. You will learn circuit components and how to build circuits on a breadboard. You will also learn important tools for testing and measuring circuits.
Microcontrollers, Motors & Sensors	This module will introduce you to microcontrollers, sensors, and motors. You will also learn the basics of programming an Arduino microcontroller.
PCB Design & Manufacturing	The PCB Design & Manufacturing module will teach you how to design and manufacture printed circuit boards. You will also learn how to solder.
3D Scanning	This module will introduce you to the uses of 3D scanning and the operation of 3D scanners. You will learn <a href="#">Meshmixer</a> .

Thermoforming	The thermoforming module will teach you how to mold plastic sheets using the <a href="#">thermoformer</a> .
Water Jetting	This module will teach you how the combination of water and abrasive at high speeds can cut through material ( <a href="#">water jet</a> ).
XR (Augmented and Virtual Reality)	This module will introduce you to the very complex topic of AR and VR. You will learn how to use a sampling of the <a href="#">equipment</a> the Makerspace offers.
Textiles	You will learn the basics of stitching and how to use the Makerspace's sewing and embroidery equipment.
Soldering	An introduction to soldering (no tutorial or DIY project). Best for students who have a need to solder but never officially learned how or need a refresher of proper technique! True soldering practice is incorporated in the PCB module.
Vinyl Cutter	This short module will introduce you to our vinyl cutting equipment.
CNC Router	You will learn how to design for and use two CNC routers to process material. One is benchtop; the other can process material on a 4'x8' bed.
Red Permit	The red permit is the mid-level permit. It is a good alternative to the green permit for students who do not wish to complete the additional training on the mills and lathes but still need access to machines like drill presses, cutoff saws, and band saws.
Green Permit	The green permit is the highest-level permit and gives students the most access to tools and machines including mills and lathes. The training and experience gained from getting a green permit will make you a better engineer.
Woodworking I	The Woodworking 1 upgrade is an additional amount of training individuals can take to learn the proper use of a variety of woodworking saws ( <a href="#">table saw</a> , <a href="#">panel saw</a> , <a href="#">circular saw</a> , track saw, and <a href="#">miter saw</a> ).

Woodworking II	The Woodworking 2 upgrade is an additional amount of training individuals can take to learn how to safely use a variety of woodworking equipment ( <a href="#">Jointer</a> , <a href="#">Thickness planer</a> , <a href="#">biscuit joiner</a> , and <a href="#">router</a> ).
Woodworking III	The Woodworking 3 upgrade is an additional amount of training individuals can take to learn how to safely use a wood lathe.
Welding I	The Welding 1 upgrade is an additional amount of training individuals can take to learn how to safely setup and use <a href="#">plasma torches</a> and <a href="#">MIG welders</a> .
Welding II	The Welding 2 upgrade is an additional amount of training individuals can take to learn how to safely setup and use a <a href="#">TIG welder</a> .
Welding III	The Welding 3 upgrade is an additional amount of training individuals can take to learn how to safely setup and use a MIG spool gun to weld aluminum.
CNC Mill I	This upgrade is self-taught and will cover basic conversational programming along with the standard canned programs (circular, rectangular pockets, rectangular frames, and bolt hole patterns) on the ProtoTRAK EMX controllers (staff will be available to answer any questions). ProtoTRAK EMX controllers are available on all Eisen mills. Training at the machine will entail working through the <a href="#">CNC Mill 1 Lab Instructions</a> to complete <a href="#">part A</a> and then, from a print alone, completing <a href="#">part B</a> .
CNC Mill II	This upgrade will introduce individuals to 2 axis machining using <a href="#">CAM software</a> generated <a href="#">G-code</a> on a 2 axis CNC mill of their choice (Trak DPM or Tormach).
CNC Mill III	This upgrade will introduce individuals to 3 axis machining using <a href="#">CAM software</a> generated <a href="#">G-code</a> on a 3 axis CNC mill of their choice (Trak DPM or Tormach).
CNC Lathe I	This upgrade will introduce individuals to basic conversational programming along with the standard canned programs (e.g. taper, radius, fillet, drill, bore, arc, thread, groove) on the CNC lathe of their choice (Bridgeport or Southwest).

CNC Lathe II	This upgrade will introduce individuals to 2 axis machining using <a href="#">CAM software</a> generated <a href="#">G-code</a> on a 2 axis CNC lathe of their choice (Bridgeport or Southwest).
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