

Digital Fabrication

THEA 4413/6413-001

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About the Class:

Digital Fabrication is an advanced design & production course. The purpose is to introduce students to the skills required to operate digital fabrication equipment (e.g laser cutter, 3D printer, CNC) using exotic or unique materials. Course will require students to become proficient in 3D drafting, 3D model editing and layout techniques (e.g. nesting, parting, interlocking, layering).

Teaching Philosophy:

This course is designed to introduce students to the machinery that will be industry standard in the future. I believe that these skills can only be learned hands on. Therefore the class will use both the Theatre Design Lab and the Digital Fabrication Lab for class lectures, demos and projects.

Student Expectations:

Attendance is required. If anyone needs help or has questions, at any time, please find me and ask. I am usually in my office or the shop if I am not in class. Three unexcused absences will result in the loss of one full letter grade for the class. Please be on time! Four late entries will qualify as 1 absence. If you are sick, call me and leave a message before you miss class! Otherwise I will consider you without excuse!! I expect you to participate in class discussions, as well as in class demos and projects.

Please understand that plagiarism in any form constitutes *academic misconduct* (as defined and discussed in the Student Handbook) and is grounds for *Summary Discipline*. Any attempt to appropriate or submit the work of another person as though it were your own constitutes plagiarism.

Disabilities

In an effort to comply with the American Disabilities Act (ADA), I strongly encourage any student with a disability condition which requires accommodation, or which may affect performance in this course, to bring this to my attention as soon as possible, either in class or in the privacy of my office. I will make a sincere effort to provide reasonable accommodation to your needs.

Texts:

TBD

Grade Break Down:

Project development and design	25%
Realized Projects	75%

Grade Scale:

95-100 A+	90-95 A	
85-89 A-	83-85 B+	80-83 B
75-79 B-	73-75 C+	70-73 C
65-69 C-	63-65 D+	60-63 D
55-59 D-	0-55 F	

Note About Projects:

There will be some time provided during the class to work on your projects. You will not have enough time to complete them in class, but you will have 24hr access to both Labs. All projects are graded and you will be given criteria at the time of the assignment. All graduate projects will require extra elements for completion (see project criteria sheet).

- Week 1. **3D Fabrication Tools**
Welcome & overview. Lab tour.
Drafting Skills (2D & 3D)
- Week 2. **CNC Software**
Creating Tool Paths 2D & 3D
- Week 3. **CNC operation**
Machine Setup, Operation & Demo
- Week 4. **Model Creation & Editing (Software)**
Lecture & Software Demos
- Week 5. **Laser cutting software, Laser Safety**
Lecture & Software Demos. Integration with CAD
Safety Training
- Week 6. **Laser Cutting & Etching**
Machine Setup, Operation & Demo
Project Work
- Week 7. **Laser Cutting for 3D**
Layering, Interlocking, and closure.
- Week 8. **3D Printing Software**
File Types, Print settings. Slicing & Control. G-code.
- Week 9. **3D Printing**
Setting and printing single filament
Print Demo
- Week 10. **3D Printing**
Setting and printing dual filament (hollow shapes)
Print Demo
- Week 11. **3D Scanning & Model Editing**
File conversion, slicing & layering for output to laser cutter if 3D Printer
- Week 12. **Embedded Electronics in Theatre Props**
Arduino Programing
- Week 13 **Embedded Electronics in Theatre Props**
Arduino and Servos
- Week 14. **Final Projects**

Digital Fabrication Projects

CNC Project:

All projects must fit within 1 SQ foot.

Grads will demonstrate all tool path types (area clearance, machine along vector, inside/outside profile. Tool paths must contain rectilinear/linear and curvilinear shapes. At least one vector must create a profile (v-groove, round-over, ogee, etc.)

Undergrads will demonstrate at least one area clearance and one other tool-path type. Tool paths must contain rectilinear/linear and curvilinear shapes.

3D Printing Projects

Project 1. Simple shape. Produce a shape using a single filament. Grads shape must have 3 surface contours, Undergrads may have 1 or more surface contours.

Project 2. Grads will produce either a hollow 3D object that implements dissolvable support material, or print multiple objects that interlock to create the finished piece.

Undergrads will produce a 3D object that incorporates at least 3 surface contours or a hollow shape.

Project 3. 3D Scanning. Scan an object and print a copy. Grads shape should be hollow; Undergrads shape should be solid.

Laser Cutting Projects

Grads will produce one object, drafted from scratch, that produces an interlocking finished object (see lantern example) and a second object that is either layered facets, or interlocking derived from a 3D scan.

Undergrads will produce an object either layered or interlocking, derived from a student generated CAD design.

Laser Etching Project

Grads will produce an etched piece using photographic research.

Undergrads will produce an etched piece developed in CAD that incorporates text and a logo design.

Embedded Electronics Project

Grads will research, develop and produce an animatronic prop using an Arduino control system, servos and at least one input sensor (e.g. time, temp, lux, etc). Moving parts must include laser cut and 3D printed pieces.

Undergrads will produce a research, develop and produce a prop that incorporates an Arduino control system and two controlled elements (e.g. led's, servo, solid state relay, etc) mving parts may be either printed or laser cut.

Final Projects

Grads will design and fabricate a structural piece of furniture to be cut on the CNC router. No fasteners will be allowed. You will be allocated 1 Sheet of 3/4" Plywood.

Undergrads will design and fabricate a decorative piece (floor standing, wall mounted or table top) from 1/4" MDF. No fasteners will be allowed. See Table example. You will be allocated 1 full sheet of 1/4" MDF.