

An Introduction to Design through Making

Tue & Thur 12:30 – 1:45 p.m.; Curry Maker Studio: Room 203 Ruffner Hall

An Introduction to Design through Making (EDIS 3050) provides a hands-on introduction to maker education. No previous experience is required. Participants have the opportunity to design and make jewelry, board games, musical instruments, 3D models, and mobile sculptures. Technologies used in the design process include digital design software and maker technologies such as 3D printers and laser cutters.

Course Web Site

The course web site is located at:

<https://www.maketolearn.org/studio/design-through-making/>

The *Make to Learn* web site provides resources that address a range of maker projects and technologies.

Course Structure

The course introduces design through a series of projects. Each project provides an introduction to a specific maker competency. All of the design projects and maker competencies have been piloted by middle school students at the *Laboratory School for Advanced Manufacturing* in the Charlottesville City Schools. These projects are designed to be readily mastered by novice makers. They have a low threshold and a high ceiling, and can be implemented in a variety of ways.

The weekly projects lead to a midterm and final project. Any of the weekly projects can be expanded into a midterm or final project.

Course Grade

The weekly design projects constitute 60 percent of the course grade. The midterm and final projects each count another 20 percent of the grade. The course grade is calculated according to the following scale.

A+ = 98-100 A = 93-97 A- = 90-92

B+ = 87-89 B = 83-86 B- = 80-82

C+ = 77-79 C = 73-76 C- = 70-72

The final course grade is based on successful completion of the weekly, midterm, and final design projects.

Course Schedule

1. Stickers and Sliceforms (Aug 27 / 29)

This activity introduces two design technologies: (1) digital die cutters and (2) 2D design software.

Assignment: Design and print a set of stickers, and cut them out using the die cutter. Use Silhouette Studio to design a slice form object. Then fabricate the object using the Silhouette die cutter and assemble it.

Design Project: Design a slice form animal and fabricate it in cardboard using the laser cutter.

2. **Designing Games and Puzzles** (*Sept 3 / 5*)

This design activity combines previously introduced technologies to create games and puzzles.

Assignment: Select one of the recommended games on the PiecePack game wiki. Fabricate the game pieces for the selected game. Play the game with a friend and write a two or three paragraph review.

Design Project: Use one of the PiecePack gaming sets as the basis for a game that you design. Fabricate the game board and tokens. Develop a set of printed rules to guide game play. Play at least one game with friends to assess the playability of the game; then write a one-page reflection to summarize your conclusions and recommendations for future enhancements.

3. **Using 2D Design Software to Develop Three Dimensional Models** (*Sept 10 / 12*)

This activity introduces design techniques for creating three-dimensional models using folded card stock.

Assignment: Fabricate a colonial house, the John Blair Kitchen, following the instructions provided.

Design Project: Design and fabricate a house using the design techniques demonstrated through the model house.

4. **Designing a Mechanical Machine That Moves** (*Sept 17 / 19*)

The previous activities involve design of static objects. This activity introduces motion through mechanical animation, replicating a nineteenth century mechanical movie machine using modern fabrication technologies.

Assignment: Fabricate a papercraft animation machine. Then design an animation sequence for use with the animation machine.

Design Project: Design and fabricate a motorized 3D-printed animation machine and an accompanying animation sequence.

5. **Designing Electrically-powered Objects** (*Sept 24 / 26*)

The previous activity involved design of a hand-powered object that moves. This activity introduces two new technologies: (1) 3D printing and design, and (2) design of electric motors.

Assignment: Fabricate a linear motor. Then use the electric motor to power a mechanism. Use the 3D design program, Fusion 360, to design and fabricate a 3D-printed pivot to move the card.

Design Project: Design and fabricate a 3D printed animatronic figure powered by a linear motor.

6. **Designing a Speaker** (*Oct 1 / 3*)

This activity builds upon the understanding of electricity and magnetism gained through design of the linear motor to design a loudspeaker.

Assignment: Design and fabricate a papercraft speaker. Use the solenoid employed in design of the linear motor to power the speaker.

Design Project: Design and fabricate a high fidelity 3D printed speaker. Analyze the frequency response of the speaker and use this information to assess its fidelity.

7. **Designing a Musical Instrument** (Oct 1 / 3)

In the speaker design activity, a solenoid was used to convert electrical energy into mechanical energy (i.e., to power the movement of the speaker cone). In this activity, the process is reversed; a solenoid is used as the pick-up for an electric guitar, converting the movement of the guitar string into electrical energy. This assignment also introduces a new fabrication technology, the laser cutter.

Assignment: Design and fabricate an electric monochord (i.e., a one-string musical instrument). Choose a song to play on the instrument (demonstrated in class).

Design Project: Design and fabricate a multi-string (four to six-string) electric instrument. As a final demonstration, play a song on the instrument that you designed.

8. *Project Week - Midterm* (Oct 10)

9. *Project Presentations* (Oct 15 / 17)

10. **Designing Jewelry** (Oct 22 / 24)

This design activity makes use of two previous technologies, the 3D printer and laser cutter, to create personalized jewelry. It also introduces a new technology, the hydraulic press, that can be used for design and fabrication of jewelry.

Assignment: Select one or more of the following maker technologies – the 3D printer, the laser cutter, or the hydraulic press – to create a custom-designed piece of jewelry.

Design Project: Use the hydraulic press, combined with other maker technologies, to design and fabricate a personalized bracelet, necklace, pin, or pendant.

11. **Designing with Light** (Nov 5 / 7)

LED light strips are becoming increasingly affordable, and lend themselves to a variety of maker activities. This design activity introduces the Arduino microcontroller.

Assignment: Use an Arduino microcontroller to create a digital pattern on an LED light strip. Use the light strip to decorate or enhance a previous project.

Design Project: Use an LED light strip and a microcontroller to create a light show.

12. **Designing with Electronics** (optional) (Nov 12 / 14)

In the following, optional activity, an electronic amplifier can be constructed to power a speaker. This final activity introduces a new technology, soldering.

Materials: Amplifier Kits

13. **Project Week** (Nov 19 / 21)

14. **Project Week** (Nov 26)

15. **Final Presentations** (Dec 3 / 5)