CLASSNUM: DIGITAL FABRICATION WITH ROBOTICS (1 credit)

Room: MakerLab / Pearlman 203

Instructor: Ian Roy

Guest Instruction: Hazal Uzunkaya, Tim Hebert

Enrollment: Limit of 8.

Course dates: (seven 180-minute classes)

Day/times:

Credits/Grading: 1 credit to be graded as Credit/No Credit

Required Reading: To be provided in class, as appropriate.

Course Overview

Digital fabrication methods are quickly changing the landscape of manufacturing worldwide. Access to cheap machines capable of rapidly producing high quality prototypes are spurring innovation across every industry that uses or makes physical stuff.

The goal of this course is for students to walk away with the ability to imagine a design and produce it in physical reality. Students will learn the fundamental underlying technologies in digital fabrication, 3D scanning, 3D design, and robotics. Through a combination of real world examples and hands on experiences, students will learn to take a design from concept to reality. There will be a focus on literacy of underlying technologies: how things work, what their limitations are, why they fail, and how to troubleshoot or design around those limitations.

As part of the course, students will examine workflows to produce 3D designs from a variety of sources, and learn 3 avenues for having them physically produced. A variety of CAD and 3D modeling tools will be used. They will examine the inner workings of 3D printers and Robots and gain hands on understanding of the capacities and limitations of each.

Each student will assemble, calibrate, tune and operate a 3D printer from parts that they will take home at the end of the course. Each student will learn to solder and assemble an electronics kit. Each student will learn to operate the 3D printers and 3D scanners in the MakerLab and be certified to have swipe access for future use. This course will cover a lot of ground, and focus will be on digital literacy and understanding what is possible today and what the implications will be for tomorrow.
LEARNING GOALS

STUDENTS WILL:
1. LEARN THE UNDERLYING TECHNOLOGIES OF DIGITAL FABRICATION, 3D DESIGN, 3D SCANNING, AND ROBOTICS.
2. LEARN TO OPERATE 3D PRINTERS IN THE MAKERLAB AND UNDERSTAND THE LANDSCAPE OF POSSIBILITIES IN 3D PRINTING TODAY.
3. LEARN TO SOLDER AND UNDERSTAND BASIC ELECTRONICS LOGIC.
4. LEARN THE VARIOUS AVENUES FOR CREATING AND FABRICATING DIGITAL DESIGNS: FROM SELF-OPERATED, TO USING A LOCAL RESOURCE, TO THE ONLINE MARKETPLACE.
5. LEARN THE SIMILARITIES BETWEEN DIGITAL FABRICATION MACHINES AND ROBOTS.
6. LEARN TO ASSEMBLE, CALIBRATE, TUNE, AND OPERATE A 3D PRINTER FROM PARTS.
7. LEARN THE IMPLICATIONS OF DIGITAL DESIGN, DIGITIZATION, AND AUTOMATION ON OUR FUTURE.
8. BUILD LITERACY IN HOW TO APPLY A DESIGN MINDSET TO DEVELOP AN IDEA INTO A PHYSICAL PROTOTYPE - AND WHAT IT TAKES TO TAKE A PROTOTYPE TO PRODUCT.

Course Requirements

Each class will start with a full roll call and attendance of all sessions is mandatory.

Each student will be required to purchase a small 3D printer kit at a cost of $100 to participate in the course.

As a 1 credit course, you should expect to spend a minimum of 3 hours/week in preparation. Most work outside of class will be video based and require work with an online software platform. If students have laptops, they should bring them to class. If they do not have one, machines will be available in the MakerLab.

Grading

Half the grade will be based on a student’s contribution to class discussion and hands on workshops. The other half of the grade will be based on a final paper.

If a student has a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please contact me immediately. Please keep in mind that reasonable accommodations are not provided retroactively.

Contact Information
www.brandeismakerlab.com

Ian Roy: ianroy@brandeis.edu - Office Hours Tuesday 3-5pm in Farber2
Hazal Uzunkaya: hazalu@brandeis.edu
Tim Hebert: thebert@brandeis.edu
### Class 1: Ian Roy  
**Pearlman 203 – Monday 10/30 2pm-5pm**

**Introduction to Digital Fabrication and 3D Design**
- 7 types of Traditional Machine Tools – basic history  
- Digital Fabrication & 3D Printing underlying technologies  
- 3D Scanning underlying technologies and applications  
- How Robots Work  
- The 5 avenues to design 3D content  
- Binary to Physical / Analogue to Digital / Bits to atoms – design ethos and iteration

**Spaces Tour**
- Backroom tour with LaserCut and Powder printer demo

### Class 2: Ian Roy and Hazal Uzunkaya  
**MakerLab – Monday 11/6 2pm-5pm**

**3D Scan and 3D Print Hands on**
- Students with create busts of themselves with consumer grade 3D scanners  
- Intro to CAD - the busts will be edited in TinkerCadd and cleaned in Netfabb  
- Students will learn to operate CreatorX 3D printers and Simplify3D on the public printers the MakerLab  
- Students will both 3D print their self-scans in the MakerLab and send them off site to be 3D printed in color.  
- All students will pass the MakerLab certification training in this session

### Class 3: Ian Roy and Tim Hebert  
**MakerLab – Monday 11/13 2pm-5pm**

**Intro to Electronics and Soldering**
- Intro to electronics Lecture  
- Each student will learn the basics of soldering and assemble a small electronics kit.  
- Lecture on Robotics, Computer Vision, and Automation

**Robotics Demo**
- Anatomy of a robot / Intro to control theory  
- Hands on Robotics demo
Class 4: Ian Roy  
Pearlman 203 – Monday 11/20 2pm-5pm

Tools and Mindsets for Innovation: How to Turn an Idea into a Product

- Different avenues for funding: Idea to prototype to pitch to funding to scale
- Overview of Elevator Pitch and How a Pitch Deck Works
- Project Case Studies: Local Brandeis Applications
- Brainstorm & open discussion

3D Printer unboxing and overview

- Each student will familiarize themselves with the parts of their 3D Printer kit
- Open Q&A about 3D Printer kit

Class 5: Ian Roy, Hazal Uzunkaya, Tim Hebert  
Gardner Jackson – Monday 11/27 2pm-5pm

3D Printer Assembly

- Hands on assembly of a small 3D Printer
- Open Q&A and support through assembly process: 8 students, 3 instructors.

Class 6: Ian Roy, Hazal Uzunkaya, Tim Hebert  
Gardner Jackson – Monday 12/4 2pm-5pm

3D Printer Assembly

- Hands on assembly of a small 3D Printer
- Open Q&A and support through assembly process: 8 students, 3 instructors.

Class 7: Ian Roy  
Gardner Jackson – Monday 12/11 2pm-5pm

3D Printer Assembly & Calibration

- Hands on assembly of a small 3D Printer
- 3D Printer test prints and calibration
- 3D Printer troubleshooting tactics: how do diagnose problems and what to do when things go wrong.
- Students will 3D print the self-scans of themselves on their 3D printers

FINAL PAPER (3 pages):
What is the most interesting implication or application you see for this technology in the future?