Maker Space fall 2016

Mr. Mittag

Required Reading and Course Materials:
A computer with access to the Internet is required for this course . If you need help getting a computer let me know I will try to help you. All lecture notes, code samples and assignments will be posted on GitHub you will receive information on how to access my GitHub account and teaching blog during the first week of school.

Course Description:
This course is designed as an introduction to digital fabrication and the world of maker culture . Not only will students gain competence in computer aided design but they will learn the basics of 3d printing and CNC. Soldering ,basic circuitry ,wood working, mold making, metal casting and coding will also be covered during this course. Upon completion students will have the basic skills necessary to build working prototypes that can be used to solve real world problems.

Grades:
The Final grade of this course will based upon the following:

Projects	50%
Homework	25%
Collaboration	25%

Expectations:

This will be a fast paced course with lots of advanced topics. Students will not only be learning electronics,writing code but will also be challenged to use their hands to physically build projects. In order to keep up with the pace of the class students are expected to be on time and prepared to work.

Challenge 0: Diversity

Questions/Research:

- Why is diversity important in a team environment?
- Why is diversity important in engineering?
- What can the arts learn from science?
- What can science learn from the arts?
- What can we do to improve diversity?

Make:

- Cite an example of how a monoculture has failed.
- Cite an example of how diversity has proven to be successful.

Project 1: Explore maker culture

Questions/Research:

- What does it mean to be a maker? What is DIY? STEM vs. STEAM?

- What are linux,GitHub,SourceForge, Stack Exchange?
- What is open source? What is a MIT license? Is open source a good business model?
- What are popular maker publications and websites?
- What is considered cutting edge fabrication?
- Is there more to being a maker than 3D printing? Oh yea? like what?

Make:

- Create and publish a tutorial about something you know how to make.

Project 2: Throwies, blinkies electronic graffiti

Questions/Research:

- What is the MIT digital media lab? Oshman engineering kitchen?What does interdisciplinary mean?
- Name the 5 best MIT pranks.
- What are led's?
- What are resistors?
- What is ohms law?
- What is a capacitor?
- What is an integrated circuit?
- What is a 555 timer?
- Give three examples of electronic graffiti.

Make:

- Create a throwy using a led, rare earth magnet and coin cell battery.
- Create a blinking led by soldering a led, resistor and a 555 timer.
- Create a throwy that can be activated with a TV remote or any other infrared remote.
- Publish a tutorial that includes your own project using LED's and a 555 timer.

Project 3: Create a video game

Questions/Research:

- What are vectors?
- What is the egyptian multiplication algorithm?
- How can you use linear algebra in collision detection?
- What is a sprite sheet?
- How can you create graphics using free open source software?
- What are the main goals of the creators of Processing?
- What is a function?
- What is a event driven programing?
- How do you "google" for solutions to coding problems? What is a "smart google search"?
- Find 10 tutorials on video game creation using the programing language Processing.

Make:

- Create a video game, either a side scroller or map based game.
- Publish your game and code online.

Project 3: Build your own micro-controller

Questions/Research:

- What is a micro-controller?
- What is arduino? Who developed it?
- What is C/C++?
- Whats a raspberry pi and how is it different than arduino?
- What were the 10 most popular arduino projects on kickstarter? In general for last year?
- What are the bare minimum components need to build an arduino?
- What is a breadboard?
- How much current does the atmega 328 need to operate?
- What is a digital signal? How is it different from an analog signal;?
- How do you create a bench top power supply from a phone charger?

Make:

- Using the bare minimum components create your own arduino board.
- Copy your favorite arduino project using your board.

Project 4: Build your own laser cutter/plotter from electronic waste

Questions/Research:

- What type of motors are used in a laser cutter, cnc, 3d printer?
- Who is the Countess of Lovelace?
- What type of controller is needed for a laser cutter?
- What is a svg file?
- Can a DVD drive supply the necessary parts to create a small laser cutter?
- Can you drive it with an arduino?
- What is sustainable technology? How does recycling align with sustainable technology?

Make:

- Build a team
- Use free open source software to create a logo for your team.
- Using electronic waste salvaged from old printers and computers build your own plotter/laser cutter.
- Print or cut an example of your team logo.

Project 5: Balsa glider

Questions/Research:

- What is cnc? What is gcode?
- What are the different types of competition gliders?
- What are the different parts of a free flight glider?

- What are the optimal ratios for the different parts?
- What is an air foil?
- How does wing shape affect flight?

Make:

- Build a team
- Create a balsa glider designed to stay in the air for a long period of time.
- Generate the necessary svg files to have your plane fabricated by cnc.
- Design packaging, construction plans and logo.
- Create a cost analysis of producing your plane.
- Set up a meeting and try to have one of the stores in Kent sell your plane.

Project 6: Architectural model for redesign of maker space at SKS

Questions/Research:

- What is cad?
- What are design principles?
- What are some needs to think about when designing a maker space?
- What works well about this space? What doesn't?
- How are the tools, projects, materials stored? Does this work well?
- What are some of the machines/processes you would like to use but aren't available?
- What are some of the machines/processes that aren't very useful?
- What are some projects you would like to work on if you took the class again?
- What is the best name for the space? Does "maker space" really work?

Make:

- Build a team.
- Using google sketchup to redesign the maker lab in the way you think is best.
- Add anything you would like to see. Take away anything that doesn't seem necessary.
- I will pick the best reworking of the space and set up a meeting for you to pitch your design to the Headmaster.

Project 7: Metal casting

Questions/Research:

- What is a foundry?
- How is the area of Kent historically tied to metal casting?
- What is the lost wax process?
- Describe three other mold making processes.
- What are the necessary components for building a foundry?
- What is charcoal and how is it made? How has the production of charcoal affected the landscape of Kent?

Make:

- As a class we will build a small aluminum foundry.
- We will use recycled aluminum cans to cast our projects.
- We will create our own charcoal using the same historical process used in this area.

Project 8: Community Building

Questions/Research:

- How do artist build communities? What do contemporary artist mean when they talk about community building as an art practice?
- What is the Wassaic Project? What is Project Row Houses? What are hacker spaces? What is Eyebeam? What is Py-Con? Maker-Faire?
- Why do organizations like the MacArthur foundation give large amounts of money to these kinds of communities?
- How can we participate?

Make:

- Go to the Kent memorial library and spend some time designing a workshop that targets the children of Kent. (10-12 year olds are your target age)
- Design your workshop to teach a mini maker class on one specific topic. For example: How to solder a led circuit or how to create a marionett puppet.
- As a class we will pitch the idea to the library and host a workshop for Kent children.

Project 9: Musical instrument

Questions/Research:

- What is an electric magnet?
- What are solenoids?
- What is induction?
- What are the different ways musical instruments produce sound?
- How can we incorporate micro-controllers and coding to produce music?

Make:

- Design a musical instrument which incorporates the use of an arduino and some physical object. This is not a project where we are creating buzzers or electrically produced sound. I'm thinking something like a Glockenspiel run by a computer. Rube Goldberg meets Steve Jobs meets Chopin…
- It should have some code that informs the instrument.
- Publish your code, design and have a concert on campus.

Project 10: Internet of things

Questions/Research:

- What is IOT?
- What is an IP address?

- What is http?
- What is the coding language used to create apps for Alexa? What is an API?
- What is a database? What is data logging? How do you set up a mysql database on a server?
- What are the dangers of having your appliances connect to the internet?
- Is it a good idea for everything to have an IP address?
- What is an esp8266 and what makes it more preferable to use than a wifi enabled arduino?
- What are the security vulnerabilities of IOT devices such as Nest and hardware store interfaces?
- What is a relay switch and why do IOT devices need them?

Make:

- Build a team
- Solicit ideas for IOT devices that would help solve problems on campus.
- Pick a problem and build a proof of concept using a esp8266 chip.
- Create a data logging IOT device that submits data to a database on a cloudserver.

Project 11: Drawing machine

Questions/Research:

- What is AI?
- What is abstraction?
- What is creativity? Are there examples of creativity exhibited by machines?
- What does Joesph Campbell say the role of the artist is?
- What is the singularity? Who is Marshal Mcluhan? What is the Turing test?
- Who are some artist that have used computers to generate their Art?
- How about language and storytelling? Can computers write books?
- What are true vs. pseudo-random numbers?
- Name some women that worked on the ENIAC project?

Make:

- Using the coding language Processing to create an Algorithm that generates an artwork. Include the use of a random number generator.
- Present the code to the class along with examples of the computer generated art.

Project 12: Your on your own kid

Make:

- Get curious.
- Build a list of questions.
- Research solutions to your questions.
- Make something and share your findings.