

Syllabus: mpsm 337 Electronic Projects for Artists

Instructor: Dana Moser dmoser@massart.edu

This 3-credit course meets Mondays 1:30-6:30 in North 272 (Electronic Projects Lab)
(Additional course info is at: <http://www.curiousart.org/electronic>)

Course Description:

(-Note: This is now a 2 semester long course. The Fall MPSM337 is followed in the Spring by MPSM311.) The purpose of this studio course is to provide skills and information that will be useful for artists who use electrical devices in their artworks. Examples will be shown to help students in incorporating/integrating electrical circuits and sensors in a variety of media including sculpture, installation and performance.

This, part 1 of the course, covers AC/DC electrical current and how to work with it safely. We start from scratch and show how to use components like breadboards, resistors, capacitors and transistors, Integrated Circuits, read schematics and build electrical circuits. It also provides a brief introduction to programming microcontrollers, a topic explored in-depth in part 2 of the course. The ultimate goal is for artists to incorporate this knowledge in the production of a final project of their own design.

Course materials, downloadable handouts and online resources to support the course are on the class website: <http://www.curiousart.org/electronic>

Course Materials:

All materials necessary for the successful completion of this course will be provided throughout the semester. However it is strongly recommended for students wanting to get into electronics that they procure their own components and tools, especially breadboards and diagnostic tools like a multimeter. As they are introduced throughout the semester, we will provide information about convenient and economical sources for these.

Departmental Goals:

Some of the SIM Departmental goals that this course addresses include:

- Learning how to articulate artistic goals and concepts and translate them into actualized projects.
- Acquiring hands-on skills in technology and interdisciplinary practice.
- Being exposed to the widest range of artistic mediums, ideas and practice.

Minimum requirements to receive credit for this course:

1. Attendance
Please let the instructor know if you will have to miss a class.
2. Successful completion of all assigned circuits [project 1 and project 2]
3. Participation with in-class projects
4. Project Description
(This is due 2 weeks before the final class.)
5. Completion of a final project of your own design
(This is due on the final week of class.)

Course Assessment and Grading:

This is a pass/no credit course. If by mid-semester the pre-determined milestones for the course have not been reached the student will receive a mid-semester warning. If by the end of the semester the student has not completed at least 80% of the minimum course requirements, the student will receive a grade of NC. Faculty will assess the student's progress during in-person meetings, in-class project reviews, and email correspondence.

Week-by-Week Description of the classes:

1. Course Introduction: Working with Electricity

Introductions, and general description of the course.

Simple circuits

- Definitions of electrical properties
- Understanding current (Water metaphor plus unit prefixes for science and engineering)
http://www.curiousart.org/electronic/include/Elect_Handout.pdf

Students will divide up into groups of “lab partners” and be assigned tools for working with electrical circuits and introduced to the proper use of *multimeters*, an important tool for working with electricity.

– Introduction to soldering and making a simple LED light with a switch.

-Examples of artists' work will be shown.

2. Project 1: a Light-Sensitive Switch

Beginning Light-Sensitive Switch [project one]

Simple circuits

- Using Breadboards
- Ohm's / Watt's Law
- The Voltage Divider
- First Project:
http://www.curiousart.org/electronic/include/Light_Sw_project.pdf

This class will introduce the crucial concept of the voltage divider (used in many sensors) as well as a number of discrete electrical components: potentiometers, diodes, transistors, switches (relays).

http://www.curiousart.org/electronic/include/Voltage_Divider.pdf

-Examples of artists' work will be shown.

3. Fun with Capacitors and IC circuits

- Transistor R/C oscillator circuit
- 555 timer IC introduction
- Oscillator / timer project [project two]

In this class we introduce some new discrete components: capacitors and transistors. In combination with the appropriate resistors, these can be used to create oscillator circuits.

[In-class project: building the 2 transistor oscillator circuit.]

Next we introduce one of the most important electrical components: the **Integrated Circuit** (IC).

The 555 an IC can be configured as a timer or oscillator.

4. Oscillator / timer project

--In order to examine oscillating electrical current, we introduce a crucial piece of electrical test equipment: the **oscilloscope**.

– A survey of sensors will be presented, including those for detecting and responding to temperature, pressure, bend, moisture, magnetic fields and light.

Most of the time in class will be devoted to working on the completion of the class project 2: the

555 circuit(s). Upon completion of the timer circuit, students will go on to alter/adjust components in order to create a *voltage controlled oscillator (VCO)* with the same IC.

5. Oscillator / timer project (finish) IC's and "Circuit Bending"

A review of some Integrated Circuits (ICs): transistors, Op Amps and logic gates

After allowing time in class to finish the timer/oscillator project, the practice of "***circuit bending***" is introduced, including best practices for documenting, safe experimentation with dis-assembled circuits. MIDI and homebrew synthesis.

6. Circuit De-Bugging and Soldering

As we finish work on Project 1, we will go over a variety of techniques for trouble-shooting our circuit design.

http://www.curiousart.org/electronic/include/light_switch_debug.pdf

Soldering on epoxy prototyping boards will be shown, as well as other considerations for semi-permanent circuits such as enclosures and connectors.

-Examples of artists' work will be shown.

7. Motors and Electro-Mechanical Survey:

- (-DC gearhead, servo, stepper)
- external switching of stepper
- In-class group projects: -555 driver for servo

A survey of motors will be presented, including the types most easily used in small kinetic projects using DC current: DC gearhead, RC servos and stepper motors.

A circuit for positioning servo motors using an adaptation of the 555 oscillator circuit built in class previously is demonstrated and might optionally be built in class.

- Beginning kinetic projects "Making Things Move"

8. Electro-Mechanical part 2:

- Finishing / Presenting Kinetic Projects
- Visiting Artist TBA

9. "Programming, oh boy!"

In this class we introduce the use of microcontrollers for programming electrical input and output. The microcontroller used is the popular ATmega328 used in the Arduino development board along with it's free Integrated Development Environment.

Basic programming in the C programming language is introduced including:

- libraries and preprocessor directives
- variables and variable assignment
- functions
- conditional testing and looping
- microcontroller input and output

10. Continuing programming Microcontrollers

Continuing with programming in the C programming language.

In this class we integrate the microcontroller with sensors that have been demonstrated and used in previous classes to create programs that respond to environmental conditions with light or electromechanical actuation.

11. Final Project Descriptions Due

We will go over the individual final project descriptions and discuss their applications as well as any possible corrections/improvements to project construction.

12. Visiting Artist and In-Class Work Day

For this class, we will have a visiting artist. There will also be time in class for de-bugging and final project work toward completion.

13. Final Projects Due

Final projects are due for this class. Students will present their final projects for discussion, feedback and documentation.

Minimum requirements for credit for this course:

1. -Attendance
2. - Completion of assigned circuits and in-class projects
3. -Project description. Due November 27th
4. -Final Project. Due December 11th

GRADING

Two grading systems are used at the college; choose the one appropriate for your course.

1. Letter grades (A, A-, B+, B, B-, C+, C, D, F, Incomplete) are given in courses offered in:

- Animation
- Architecture
- Art Education
- Fashion Design
- Graphic Design
- History of Art
- Illustration
- Industrial Design
- Liberal Arts
- Master of Architecture
- Master of Arts in Teaching/Art Education
- Master of Science in Art Education

2. Pass/No Credit/Incomplete grades are given in courses offered in:

- Studio Foundation courses
- Film/Video
- Fine Arts 2D
- Fine Arts 3D
- Photography
- Studio for Interrelated Media
- Master of Fine Arts

1. Grades are defined as follows:

- A – Exceptional work in all respects.
- B – Above average work, distinguished in certain but not all respects.
- C – Average. Individual departmental policies may set standards for the application of “C” grades toward progress in the major.
- D – Below average work. This is the lowest passing grade; individual departments may set standards for the application of “D” grades toward progress in the major.
- F – Failing work. No credit is given.

Pass – Work meeting all expectations for successful completion of the course.

NC – No Credit Work that does not meet the expectations of the course.

INC – Incomplete. A temporary designation indicating that at least 80% of the course requirements have been met and that the remaining course requirements are expected to be completed, and a permanent designation issued by the subsequent mid-semester. The student is responsible for having an Individual Grade Sheet completed by the appropriate faculty member and filed with the Registrar. If the student does not complete the course work, a non-passing grade will be issued.

Department Academic Progress

A student who earns a no credit in a major requirement or two no credits in major electives over two semesters is placed on probation. A student on probation who earns a no credit in a major requirement is subject to dismissal from the department.

Course Attendance

The college-wide policy permits no more than two absences per semester for a course that meets once a week prorated for classes that meet on a different schedule.

Plagiarism

Whenever your work incorporates someone else's research, images, words, or ideas, you must properly identify the source unless you can reasonably expect knowledgeable people to recognize it. Proper citation gives credit where it is due and enables your readers to locate sources and pursue lines of inquiry raised by your paper. Students who do not comply will be penalized. For further information, see the MassArt Student Handbook or consult with the Academic Resource Center.

Classroom Accommodations for Students with Disabilities

Massachusetts College of Art and Design is committed to fostering the academic, personal, and professional growth of our students. We are especially committed to ensuring that students with documented disabilities, as defined under the Americans with Disabilities Amendments Act of 2008 (ADAAA), are provided equal access to all campus resources and opportunities. If you believe you have a disability that may warrant accommodations, I urge you to contact Ms. Erla Shehu (Erla.Shehu@massart.edu or 617-879-7692) in the Academic Resource Center (formerly the Learning Center), Tower 550. The Academic Resource Center provides access to a learning specialist, an academic coach and professional tutors.