Union College
ECE101: The Joy of Electronics
Syllabus Winter 2016

Catalog Description:
ECE101: Introduction to the tools, skills, and principles of electrical and computer engineering. Emphasis is placed on developing an intuitive understanding while learning quantitative methods to design, test, and analyze electronics. Test and measurement tools include oscilloscopes, multimeters, and function generators. Circuit construction techniques include breadboarding and soldering as well as computer software to simulate circuits. Principles such as power, frequency, and modulation are taught through analog and digital electronics projects. Hands-on projects include an audio amplifier, crystal radio receiver, and a microcontroller-operated robotic arm. Prerequisites: None.

Instructor:
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Class:
Section 1 lecture is held in NWSE 106 Tuesday and Thursday from 9:00 AM to 10:45 AM.
Section 2 lecture is held in NWSE 106 Tuesday and Thursday from 10:55 AM to 12:40 PM.
Section 3 lecture is held in NWSE 106 Monday, Wednesday, and Friday 10:30 AM to 11:35 PM
Textbook: None.

Course Objectives:
By the end of the course, the successful student will be able to:

- Measure voltages and currents in a circuit using a multimeter and oscilloscope.
- Use a function generator to provide AC signals to test circuits such as an audio amplifier connected to a speaker.
- Identify basic electronics components such as resistors, capacitors, and inductors.
- Create circuit diagrams and identify basic components.
- Simulate a simple circuit and compare its operation to experiment.
- Construct a breadboard circuit based on a circuit diagram.
- Solder a simple audio amplifier circuit.
- Identify series, parallel, open, and short circuits.
- Debug a circuit.
- Program a microcontroller to perform simple control tasks involving hardware such as LEDs and motors.
- Build a simple AM radio system to transmit and receive voice signals.
- Identify the magnitude and frequency of AC signals such as sinusoid, triangle, and square waves.

Schedule - This schedule is approximate and subject to change:

Week	Concept(s)	In class exercises	Project
1	DC circuits: 1. Sources of electrical energy. 2. What a circuit is 3. Shorts and opens 4. Series and parallel circuits 5. Ohm's law 6. Measuring current and voltage using a multimeter. 7. DC power.	1. Wimshurst machine. Battery, lamp, wire, stripper exercise 2. Use digital circuits consisting of switches and an LED to introduce series and parallel circuits. 3. Use LED and resistor to introduce ohm's law.	
2	AC circuits. 1. Frequency 2. AC voltage, current, and RMS power 3. Capacitors 4. Inductors 5. Filters 6. Speakers 7. Use AudioXPlorer to examine audio.	1. Use a function generator to produce AC signals. 2. Measure AC voltages and currents with a multi-meter and oscilloscope. 3. Use a scope to measure RMS power in a resistor. 4. Computer simulation of RMS power in a resistor. 5. Computer simulation of a LM380 audio amplifier chip 6. Breadboard the LM380 chip. 7. Test the audio amplifier and compare with simulation.	Audio Amplifier
3	Electronic construction techniques 1. Breadboard 2. Solder	1. Solder wires together 2. Solder wires to a PCB 3. Solder the audio amplifier.	Audio Amplifier (Solder)
4	Complete project 1 and hand in with Report		
5	**Lab** **Exam 1**	**Lab** **Exam 1**	

6	Radio 1. Tuned circuits 2. AM modulation 3. Antennas 4. AM demodulation Filters	1. Build the crystal radio. 2. Observe RF modulated and demodulated signals at various points in the radio circuit.	Radio (crystal receiver)
7	Complete crystal radio		Radio (crystal receiver)
8	Radio 1. Implementing AM modulation 2. Implementing AM transmitter	1. Build a simple AM radio transmitter. 2. Listen to voice signals transmitted and received with simple radio system.	Radio (AM transmitter)
9	**Lab Exam 2** Robotics 1. Basics of motors 2. DC motor 3. Servo motor 4. Load, velocity, acceleration, torque	**Lab Exam 2** 1. Build a simple robot arm with gripper. 2. Add motors to move the arm and actuate the gripper.	Robot arm (manual control)
10	Robotics 1. What's a microcontroller? 2. Basic architecture 3. Programming interface 4. Interface with hardware	1. Complete exercises that demonstrate the use of programming constructs to control hardware. These constructs include: assignment of values to variables, looping, decisions, and input/output. 2. Implement a program on a microcontroller to control the movement of the robot arm by controlling the arm and gripper motors.	Robot arm (microcontroller)

Attendance: Attendance is mandatory and three points will be deducted from the final numeric grade for each unexcused absence. If you must be absent you must talk to me.

Grading:
Student grades will be based on the grades for: four graded projects (which consist of a pre-lab assignments, a quiz, and a report), two lab exams, and a graded portfolio. All projects and assignments will have a due date and points will be deducted for lateness.

Summary of Grading:
The final grade will be calculated in the following way:

Assignments/Quizzes	15%
Portfolio	10%
Exam 1	10%
Exam 2	10%
Projects	60%

The translation from numeric to letter grade will use the following:

Numeric Grade	Numeric Grade
93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
60-69	D
59 and below	F