Course Syllabus for
PHYS375 — Laboratory Electronics (I)

Course Information

Semester: Fall 2017

Credit hours: 4

Class time: Mondays and Wednesdays 1:30PM - 3:30PM

Class room: La Tourette Hall 233

Textbooks: Hands-On Electronics: A Practical Introduction to Analog and Digital Circuits (Recommended)
Daniel M. Kaplan and Christopher G. White, ISBN-13: 978-0521893510
An Introduction to Modern Electronics
William L. Faissier, ISBN: 978-0-471-62242-0

Instructor Contact Information

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Teaching Philosophy

1. A teacher should be a good motivator.
2. Practice makes perfect: labs are crucial to learn about electronics.
3. A course's outcome should be judged by how much the students learned rather how much the teacher taught.

Course Description

Fundamentals of circuit analysis and the physics of electronic devices. Topics include DC and AC circuits, signal transmission, noise, feedback, semiconductors, operational amplifiers, and simple digital logic.

Prerequisites & Notes

PHYS 252 or PHYS 273 or consent of the department.

Course Goals and Objectives

1. Teach students the physics and functions of electronic components.
2. Teach students fundamentals of circuit analysis.

3. Provide students hands-on experience on electronics.
4. Enable students to build simple electronic circuits.

Student Learning Outcomes

Upon successful completion of this course the students will
1. be familiar with the basic properties of elementary circuit components (resistors, capacitors, diodes and transistors) and be able to use them in simple circuits.
2. be able to carry out elementary circuit analysis and be familiar with how this analysis can be extended to include active devices, such as transistors and op-amps
3. be able to design and use some of the basic circuits, including simple amplifier and oscillators.
4. have the ability to master and use additional devices.

Instructional Methods

1) Lectures and 2) labs.

Course Assessment

Grading: Labs 30%; homework (20 %); mid-term 20%; final exam 20 %; attendance and class interaction 10%

Grading scale: A (≥ 90%), A^- (85%~89%), B^+ (80%~ 84%), B (75%~79%), B^- (70%~74%), C^+ (65%~69%), C (55%~64%), D (40%~54%)

Course Resources

http://nicadd.niu.edu/~fortner/course/phys375/Phys375_desc.html
http://nicadd.niu.edu/~piot/phys_375/index.html

Accessibility Statement

Northern Illinois University is committed to providing an accessible educational environment in collaboration with the Disability Resource Center (DRC). Any student requiring an academic accommodation due to a disability should let his or her faculty member know as soon as possible. Students who need academic accommodations based on the impact of a disability will be encouraged to contact the DRC if they have not done so already. The DRC is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu.

Class Schedule (tentative)

Date	**Lecture/Lab**
08/28	Introduction
08/30	**Basics:** energy storage hydrological analogy; voltage; current; power; conductivity and Ohm's law; Kirchoff law; Series and parallel circuits; Thevenin and Northon theorems
09/04	**Labor day**
09/06	Lab 1

09/11	**Alternating and direct currents:** DC versus AC; Fourier analysis and complex notation; Characterizing AC signal; resistance in AC signal; capacitance and capacitors; RC circuits
09/13	Lab 2
09/18	**Oscillators & resonances:** inductor; inductance versus capacitance; the RLC circuits and its analogy with the mechanical pendulum; resonances
09/20	Lab 3
09/25	**Signal transmission & noise:** transmission line; coupling scheme; termination and impedance matching; optical analogy; noise
09/27	Lab 4
10/02	**Operational amplifier**: properties and "golden rules"; ideal versus real-life operational amplifier; example of circuits analysis with operational amplifier
10/04	Lab 5
10/09	**Amplifier and feed-back system**: voltage amplifier; common emitter amplifier; feedback system and advantage of negative feedback scheme
10/11	Lab 6
10/16	Argonne visit
10/18	**Midterm exam**
10/23	**Analog computer**: setting up equation with electronics
10/25	Lab 7
10/30	**Semiconductors:** quantum mechanics background, band theory, Fermi level; doping; p-n junctions; diodes
11/01	Lab 8
10/06	**Transistors:** bipolar junction transistors; field emission transistors; example of circuit analysis with transistors
11/08	Lab 9
11/13	**Controls:** conventional switches; transistor-based control
11/15	Lab 10
11/20	**Current & voltage sources:** transistor-based sources; signal shaping (clipping, rectification)
11/22	**Thanksgiving break**
11/27	Lab 11
11/29	**Logic gates:** Boolean algebra; standard logic gates; implementation (CMOS and TTL)
12/04	Lab 12
12/06	Review
12/11	**Final exam**