AEP3630/P3360 Electronic Circuits, Spring 2022

INSTRUCTOR: Dr. E. J. Kirkland (ejk14@cornell.edu, 237 Clark Hall)

OFFICE HOURS: 2-3:30 PM Mon. on Canvas/Zoom, may be changed if needed

LECTURE: Tues/Thurs 9:40-10:55 AM, Rockefeller 115 (start on Canvas/Zoom)

LAB: Tues/Thurs or Wed/Fri 1:30-4:30 PM (except where noted in the lab schedule),
Clark 409,411,413,415,417,419 (west side of Clark facing Arts quad),
enter through fourth floor elevators (doors open during lab hours) ,
An instructor must be present during lab hours. Follow covid safety rules.
For covid safety, will start all virtual and later crowding in lab will be reduced by converting some experiments to ECAD (LTspice) at home and some in-person.

BOOKS: REQUIRED: *AEP3630/P3360 Laboratory Manual, 2021/2022, Jun 2021*
by E. Kirkland and R. Littauer
OPTIONAL: Scherz and Monk, *Practical Electronics for Inventors, 4th edit.*
(lots of worked examples and a practical discussion of how to build electronics
- on-line link on course web site (use CU library passkey if off-campus)
OPTIONAL: Horowitz and Hill, *The Art of Electronics, 3rd edit.*
(more advanced reference with practical discussion of how to build electronics)

WEB URL: mainly canvas.cornell.edu and some on courses.cit.cornell.edu/aep3630/

COURSE GRADE: A final grade will be based roughly on the following:
45% lab (written reports and performance in lab),
40% exams (1 prelim on chap. I-V and 1 final on chap. I-XII;
(prelim may be in-class or take-home, tentatively scheduled for about Tue. Mar. 29)
(final may be scheduled, take-home or project depending how covid changes),
15% homework

HOMEWORK: An assignment will be handed out every Tues. and usually be due the following Tues. (on Canvas). Solutions will be posted one week after the homework is due (with a 1 week grace period). If handed in after the due date but before a solution is handed out, it is half credit. Homework will not be accepted after a solution has been handed out. You may discuss the homework and labs with other students in the class but what you hand in must be your own work and not copied from someone else. Downloading solutions or copying from someone else is not acceptable. The exams may include problems from the homework and labs. If you have not worked the problems yourself, you may have difficulty with the exams.

LAB TAs: Tues./Thurs.: Scott Allen (sea98)
Wed./Fri.: Lawrence Lin (ltl32), and Jena Shields (jls627)

ADDITIONAL READING LIST: (should be in the Math Library)
some contain an assortment of worked examples and practice problems
Horowitz and Hill, *The Art of Electronics, 3rd edit.*
L. R. Fortney, *Prin. of Electronics, Analog and Digital* - library can't find this?;
P. R. Gray, P. J. Hurst, S. H. Lewis and R. G. Meyer,
Analysis and Design of Analog Integrated Circuits, 4th edit.;
J. Millman and A. Grabel, *Microelectronics*;

R.E. Simpson, *Intro. Electronics, 2nd edit.*;
John F. Wakerly, *Digital Design Principles and Practice*, 3rd edit.

Electronics and electronic instrumentation are widely used in scientific and engineering research as well as everyday life. Almost every experiment uses electronics for measurement and control. This course is designed to introduce practical electronics as might be encountered in a scientific or engineering laboratory (using discrete components and integrated circuits). It will cover how to analyze and design electronic circuits appropriate for lab instrumentation and test them experimentally. A large variety of topics are surveyed in enough depth to be useful but perhaps not a thorough in-depth study. The course starts at an introductory level and moves quickly through many different topics. The necessary background is some laboratory work with DC circuits (i.e. Ohm's law), AC signals, and oscilloscopes (such as in Physics 2208 or 2213), but no other electronics experience is assumed. The main goals are to learn electronics as might be needed for more advanced experiments and measurements, practice how to record experimental data and quantitatively compare to theoretical predictions, and general lab skills.

The lab work is strongly emphasized, and will follow the experiments outlined in the lab manual. Chapters 1-7 cover mainly analog electronics (resistors, capacitors, RC circuits, integrated circuit operational amplifiers, filters, diodes, bipolar and MOSFET transistors) and comprise a little over half the course. Chapters 8-10 cover digital electronics (gates, adders, flip-flops, counters, shift registers, timers and one-shots) with an introduction to sensors and transducers (audio speakers in chp. 6 and an ultrasonic range finder in chp. 10). And finally in chapters 11-12 computer interfacing is introduced and used to investigate digital to analog conversion (DAC), analog to digital conversion (ADC) and signal sampling and averaging using an Arduino.

All of the lab experiments outlined in the lab manual are required unless stated otherwise. Both lab attendance and written lab reports are mandatory. Failure to do all labs or failure to take the exams may result in a rather poor grade. The lectures will mainly serve to provide the required background for the lab experiments to be done later in the week, with some additional material where appropriate.

Covid makes this semester unpredictable and requires a flexible hybrid lab format instead of a normal in-person lab. The first two weeks are required to be all virtual, so the labs will start with ECAD (LTspice) computer simulations of some experiments. Hopefully, covid will allow us to do some in-person experiments later in the semester. There are a large number of students currently enrolled and spending a long time together in a normally crowded small lab space is probably unsafe. The semester will continue with some experiments in ECAD and some in person to reduce crowding in the lab where possible. The organization may change as the pandemic changes.

Cornell University Code of Academic Integrity:

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Discussion and collaboration on homework and laboratory assignments is permitted and encouraged, but final work should represent the student's own understanding.

Course materials posted on-line are intellectual property belonging to the author. Students are not permitted to buy or sell any course materials without the express permission of the instructor. Such unauthorized behavior will constitute academic misconduct.