

CHM 6158C
ELECTRONICS AND INSTRUMENTATION
Spring Semester 2022, 3 Credits

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Lectures: M W, 11:45AM-12:35PM (Period 5), FLI 257

Labs: M W, 12:50PM-3:50PM (Periods 6-8), FLI 257
T R, 12:50PM-3:50PM (Periods 6-8), FLI 257

Office hours: Drop by my office anytime, see me after lecture, or e-mail me to set up an appointment.

Course description: CHM 4143C/6158C is a combined lecture and laboratory class, providing students with an understanding of the principles and applications of electronic devices and techniques employed in modern computerized scientific measurements in analytical and physical chemistry.

Course objectives: It is expected that by the end of the course students will be familiar with basics of electronics circuits, including DC measurements, logic circuits, and op-amp circuits. The students will also have acquired sufficient coding experience, and should be able to design a LabView project to automate and control laboratory measurements.

Textbook: "Principles of Electronic Instrumentation," 3rd Edition, A. James Diefenderfer and Brian E. Holton; \$172.79 (Amazon, new), \$33.88 (Amazon, used). "The Art of Electronics," 3rd Edition, Paul Horowitz and Winfield Hill; \$82.07 (Amazon, new), \$62.00 (Amazon, used). These books are not required, but may serve as useful references.

Grading: Grades will be based on labs (55%), a final project (15%), a mid-term exam (15%), and a final exam (15%).
Mid-term: The mid-term exam takes place on **Wednesday, February 16th in FLI 257.**
Final exam: The cumulative final exam takes place on **Thursday, April 28th at 10:00AM in FLI 257.**

Information on current UF grading policies is online: (<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>).

Course policies:

Attendance at all class/discussion sessions and **at least 6 hours of lab per week** is expected. Any request for make-up exams should be made to Dr. Prentice as far in advance as possible. Absences are subject to UF regulations <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

UF students are bound by The Honor Pledge which states: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honorcode/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class."

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

For counseling the following resources are available to students: **U Matter, We Care:** If you or a friend is in distress, please contact umatter@ufl.edu or 352-392- 1575. **Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc/Default.aspx>, 352-392-1575; the University Police Department: 352-392-1111 or 911 for emergencies. **Sexual Assault Recovery Services (SARS):** Student Health Care Center, 352-392-1161.

Lab experiments: There are a total of 7 lab units that will be covered in the laboratory section of the course. The sequence of experiments deals with measurement instrumentation, digital logic, data acquisition using LabVIEW, power supplies, op amps, etc.

A lab “period” consists of a 3-hour lab session. Students have to choose among three options: **MW 6-8 or TR 6-8**. Instructions for the lab exercises will be posted on the E-learning website.

Students are required to hand in lab reports within **1 week of completing the lab**. Note that performance in these lab units largely determines your grade.

While discussion of the lab material with colleagues is encouraged, the lab report must be completed independently by each student. **Plagiarism will not be tolerated and will be reported.**

The final project involves the design of an apparatus or software program that can control or automate measurements in the laboratory. Ideally, this project aids the student’s research endeavors.

TENTATIVE LAB SCHEDULE

| <u>Date</u> | <u>Lab</u> | <u>Topic</u> | <u>Points</u> | <u>Lab Start & (Due) Dates</u> |
|-----------------------------------|------------|--|---------------|------------------------------------|
| Week 2 <i>(2 periods)</i> | 1 | Breadboarding, DC Voltage measurements, Analog Signals | 50 | 1/10 <i>(1/19)</i> |
| Week 3-4 <i>(3 periods)</i> | 2 | Digital Signals, Logic Gates, Flip-Flops, Counters | 75 | 1/17 <i>(1/31)</i> |
| Week 4-6 <i>(5 periods)</i> | 3 | LabVIEW and Virtual Instruments | 125 | 1/26 <i>(2/16)</i> |
| Week 7-8 <i>(4 periods)</i> | 4 | AC Measurements | 100 | 2/14 <i>(3/2)</i> |
| Week 9 <i>(1 period)</i> | 5 | Arduino | 50 | 2/28 <i>(3/14)</i> |
| Week 10-11 <i>(4 periods)</i> | 6 | Operational Amplifiers and Power Supplies | 100 | 3/14 <i>(3/30)</i> |
| Week 10 -11 <i>(4 periods)</i> | 6.5 | LT Spice (In-Lecture) | 50 | 3/16 <i>(3/30)</i> |
| Week 12-14 <i>(4 periods)</i> | 7 | Final Projects | 150 | 3/28 <i>(4/11)</i> |
| Lab Total | | | 700 | |
| Mid-term Exam | | | 150 | |
| Final Exam | | | 150 | |
| Course Total | | | 1000 | |

TENTATIVE LECTURE SCHEDULE

| <u>Date</u> | <u>Lecture</u> | <u>Topic</u> | <u>Lab</u> | <u>Textbook</u> |
|---------------|----------------|---|------------|-----------------|
| M 1/3 | | <i>No class</i> | | |
| W 1/5 | 1 | Course Overview | | |
| M 1/10 | 2 | DC circuits, Kirchhoff's Laws | 1 | DH Ch. 1 |
| W 1/12 | 3 | Capacitors, diodes, transistors | 1 | DH Ch. 2 |
| M 1/17 | | <i>No class- MLK Day</i> | 2 | |
| W 1/19 | 4 | Binary number system, electrically encoded information | 2 | DH Ch. 13 |
| M 1/24 | 5 | Digital logic, logic families | 2 | DH Ch. 11 |
| W 1/26 | 6 | Review & Discussion | 3 | |
| M 1/31 | 7 | LabVIEW Introduction | 3 | DH Ch. 12 |
| W 2/2 | 8 | DMM, oscilloscope, function generator | 3 | DH Ch. 6 |
| M 2/7 | 9 | Op amps | 3 | DH Ch. 9 |
| W 2/9 | 10 | Op amp circuits | 3 | DH Ch. 9 |
| M 2/14 | 11 | Review & Discussion | 4 | |
| W 2/16 | | Mid-term Exam (up to 2/19) | 4 | |
| M 2/21 | 12 | Mid-term Exam Review & Discussion | 4 | |
| W 2/23 | 13 | AC Circuits | 4 | DH Ch. 3 |
| M 2/28 | 14 | RF amplification and resonant RF circuits | 5 | DH Ch. 4 |
| W 3/2 | 15 | Filters, noise, digitization | | DH Ch. 15 |
| M 3/7 | | <i>No class- Spring Break</i> | | |
| W 3/9 | | <i>No class- Spring Break</i> | | |
| M 3/14 | 16 | LT Spice | 6 | |
| W 3/16 | | LT Spice Lab (In-lecture) | 6 | |
| M 3/21 | | LT Spice Lab (In-lecture) | 6 | |
| W 3/23 | | LT Spice Lab (In-lecture) | 6 | |
| M 3/28 | 17 | Review & Discussion | 7 | |
| W 3/30 | | <i>Office hour for project</i> | 7 | |
| M 4/4 | | <i>Office hour for project</i> | 7 | |
| W 4/6 | 18 | Guest Lecture: Stan Pych (Electronics shop troubleshooting) | 7 | |
| M 4/11 | | Presentation of projects | | |
| W 4/13 | | Presentation of projects | | |
| M 4/18 | | Presentation of projects | | |
| W 4/20 | | Presentation of projects | | |
| R 4/28 | | Final Exam | | |