THE UNIVERSITY OF ARIZONA

SYLLABUS
OPTI 380B (1 unit)
Intermediate Optics Lab II
Spring 2023

Lab Schedule: (Room 450, Optical Sciences Center)

Tuesday	Wednesday	Thursday
9:30 am-12:20 pm--sec. A	---	
2:00-4:50 pm--sec. B		2:00-4:50 pm--sec. G
	5:00-7:50 pm--sec. E	

Lab Lecture (Mon. 12:00–12:50 pm; in-person, Room 422)

Description of Course

This lab course has been designed to closely follow ECE 207 <u>Elements of Electrical Engineering</u> or ECE 220 <u>Basic Circuits</u>. It provides hands-on experience with most of the concepts taught in these courses. If you are majoring in Optics, then 380B is a required course. It is expected that you have taken either ECE 207 or ECE 220 before taking this course, OPTI 380B.

Course Prerequisites or Co-requisites

Students must be enrolled in, or have already taken ECE 220 or ECE 207.

Instructor and Contact Information

Prof. Michael Nofziger ("Dr. Mike")
Meinel 412A
520-626-8363
nofziger@optics.arizona.edu
Office Hours: Tue. 1:00–3:00 pm or by appointment
Web information: Course notes may be found on the D2L site for this course, OPTI 380B.

Course Format and Teaching Methods

Weekly Labs (in-person) with a weekly Lab Lecture (remote on zoom).

Course Objectives

The main objectives for this lab are to learn the basics of electronic measurements, and how to construct and make measurements of basic circuits—basic analytical instruments, linear and non-linear circuit elements, transistors, op-amps, active filters, oscillators, voltage regulators, logic, gates and flip-flops, counters and registers, data converters, and computer interfacing, programming, and data acquisition.

Expected Learning Outcomes, & Relationship to ABET a-k Objectives
Upon successful completion of this course, students will be able to:

- use an electronic breadboard to build circuits   (k)
- use various electronic instruments: (k)
     (digital multi-meters, power supplies, oscilloscopes, function generators)
- design and build simple circuits
- use the Arduino microcontroller to: (a,b,k)
     - write simple C++ programs to control hardware
     - interface to and write data to LCD displays
     - run various motors (DC, stepper, servo motors)
     - digitize analog signals using the built-in A/D converter
     - interface to and read signals from various sensors (light, temperature, humidity, etc.)
     - interface to and control a LIDAR
- integrate all aspects of the Arduino labs to build a system that digitizes, records and displays measurements of a real-world space (our lab room, the light shaft in our building, etc.)   (b,e)

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: https://catalog.arizona.edu/policy/class-attendance-and-participation

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/policies/attendance-policies-and-practices

Participating in the course, and attending lectures in-person are vital to the learning process and critical to being successful in this course. Our class lectures and discussions will add information and details to our textbook and our online lecture notes.

As such, attendance is expected, but not required, at all lectures. Absences will likely affect your learning of the material, and therefore your final course grade. If you are unable to participate in class activities for whatever reason, please contact me (Dr. Mike) as soon as possible.
"If you are experiencing unexpected barriers to your success in your courses, please talk with your Undergraduate Academic Advisor. To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu. The Dean of Students Office is a central support resource for all students and also may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057."

Required Texts or Readings
- All lab handouts and class notes are available on our class D2L webpage.
- Textbooks we'll be using are available on our class D2L webpage.
- You are required to keep lab notes in some type of bound lab notebook:
     (no loose sheets of paper or 3-ring binders, etc.).

Required or Special Materials
None.

Assignments and Examinations: Schedule/Due Dates

Weekly Lab Work (a.k.a. "this is what's DUE each week"):
For each lab, the following work will be due:
- (a) Lab Objectives
- (b) Schematic Diagram(s)
- (c) Pre-Lab Questions

- (d) Lab Notebook—answers to all "In-Lab" Questions + (entries, observations, notes, etc.)
- (e) Lab Summary
- (f) Post-Lab Questions

► All work is to be submitted electronically to the appropriate Assignment dropbox in D2L. Nothing is to be turned in on paper.
► Parts (a)–(c) are to be turned in to D2L as a single pdf file ("yourlastname Lab# abc.pdf")
    (this file is <u>DUE at the start of the lab</u>)
► Parts (d)–(f) are to be turned in to D2L as a single pdf file ("yourlastname Lab# def.pdf")
    (this file is <u>DUE at the start of the following week's lab</u>)

All Lab Work MUST be your own work, written in your own words. Parts (a) "Lab Objectives" and (e) "Lab Summary" must be typed. To the extent possible, type your answers to all Pre-Lab Questions and Post-Lab Questions, the exception being for equations—they may be hand-written and scanned. Answers to all "In-Lab" Questions may be answered either in your notebook or electronically, <u>but answered during lab</u>.

Final Examination or Project

There is no final exam in this course. Instead, the Final Analysis assignment takes the place of a final exam:

Final Analysis:
This will take the place of a traditional final lab report. Identify 3 specific things that you don't understand about material covered in OPTI 380B, OPTI 330, OPTI 340, or OPTI 370. Think critically about what it is that you don't understand about each item, and why you have had trouble understanding it. Write at least a half page for each item, explaining this. Full credit will be earned for <u>length</u> (writing at least half of a page for each item), and <u>content</u> (the extent to which you demonstrate 'critical' thinking about your misunderstandings).

Final Analysis is due by 5pm, Wed. May 3, 2023.

Grading Scale and Policies

Lab Objectives	10 points/lab x 13 labs =	130
Schematics	10 points/lab x 13 labs =	130
Lab Notebook + Questions	25 points/lab x 13 labs =	325
Pre-Lab and Post-Lab Questions	45 points/lab x 13 labs =	585
Lab Summary	10 points/lab x 13 labs =	130
Final Analysis	100 points	100
	TOTAL POINTS	**1400**

- <u>Final grading for the class will be done on a curve</u>. If your score falls "in-between" letter grades, input from your TA will be used to assess how you performed in lab, to make a final decision on your grade.

- **LATE POLICY: Unexcused late material will be accepted up to a week after it was due, and will be graded at 75% off. If you miss a lab, it may be made up only because of medical reasons, or family emergency. The lab should be made up as soon as you are able to return to campus. Makeup work with an excuse will be graded with no penalty.**

(a) Lab Objectives: **(10 points)**
This is a written exercise for you to think about and define the <u>objective</u>(s) for each circuit that you will build and test, before actually doing the lab. Write this in paragraph form, using complete sentences (one paragraph per circuit or experiment).

(b) Schematics: **(10 points)**
Draw a <u>schematic diagram</u> for "selected" circuits you will build.

(c) and (f)   Pre-Lab and Post-Lab Questions: **(45 points)**
<u>Pre-Lab Questions</u>:   **(PL#)**   Due at the start of your lab.
<u>Post-Lab Questions</u>: **(L#)**   Due at the start of the next lab.

(d) Lab Notebook   **(25 points)**
Your lab notebook must include the following for full credit:
       --All <u>raw data</u> that you took (numbers, tables, graphs, etc.).
       --All <u>observations</u> that you made.
       --"<u>In-Lab</u>" Notebook Questions: **[Q#]**
          Answered in your notebook during lab, clearly labeled [Q#].

(e) Lab Summary   **(10 points)**
A <u>summary</u> of what actually happened, what you observed and did in the lab, and any problems you may have encountered.

Scheduled Topics/Activities

Week 0:   9 January 2023
NO LABS this week—Get a bound notebook, read Lab #1, and answer the Pre-Lab Questions.

Week 1:   16 January 2023
Lab 1:   Basic Circuit Construction and Electronic Instrumentation
NO Lab Lecture this week—MLK Holiday on Monday

Week 2:   23 January 2023
Lab 2:   Linear and Non-linear Circuit Elements and Networks

Week 3:   30 January 2023
Lab 3:   Introduction to LabView and GPIB Interfacing

Week 4:   6 February 2023
Lab 4:   Op-Amps I: Introduction

Week 5:   13 February 2023
Lab 5:   Op-Amps II: Circuits

Week 6:   20 February 2023
Lab 6:   Digital Logic: Introduction to Logic Gates and the Arduino I/O

Week 7:   27 February 2023
Lab 7:   Data Acquisition, FFT, and Aliasing

Week 8:   6 March 2023
NO Labs this week: Spring Break!

Week 9:   13 March 2023
Lab 8:   Design Project: "Automatic LED Night Light"

Week 10:   20 March 2023
Lab 9:   Microcontroller I
              "Basics of the Arduino Microcontroller, I2C bus, Digital I/O"

Week 11:   27 March 2023
Lab 10:   Microcontroller II
              "DC Motors, Stepper Motors and Servo Motors"

Week 12:   3 April 2023
Lab 11:   Microcontroller III
              "A/D Converter, Data Acquisition and Storage"

Week 13:   10 April 2023
Lab 12/13:   Microcontroller Data Acquisition Design Project…

Week 14:   17 April 2023
Lab 12/13:   Microcontroller Data Acquisition Design Project…

Week 15:   24 April 2023
Lab 12/13:   …Microcontroller Data Acquisition Design Project.

Week 16:   1 May 2023
NO LABS--*Last Week of Classes*
              Final Analysis and Lab 12/13 due by 5pm, Wed. May 3.

Week 17:   8 May 2023
NO LABS--*FINAL EXAM Week*

Incomplete (I) or Withdrawl (W)

"**Requests for incomplete (I) or withdrawal (W)** must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively."

(28 March)   LAST DAY TO WITHDRAW FROM A CLASS ONLINE THROUGH UACCESS

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Please refrain from disruptive conversations with people sitting around you during our Lab Lectures (which includes whispering with your neighbor). Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave the classroom. However, I strongly <u>encourage</u> questions during class!

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

Please be aware that the accessible table and chairs in our classroom (room 410) should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

"Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: https://deanofstudents.arizona.edu/policies/code-academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement."

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

Student Assistance and Advocacy information is available at https://deanofstudents.arizona.edu/support/student-assistance

Confidentiality of Student Records

http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.