

APPL114
Arduino Bootcamp
A Deep Intro for Beginners
Summer I, 2021

0.5Cr

<p>Introduction</p> 	<p>Make electronics do cool things!</p> <p>This course is for anyone – student, researcher, hobbyist, etc. -- who has an interest in getting into the world of electronics and microcontrollers. No prior experience is required. We will be using the popular Arduino hardware/software ecosystem to learn basic hands-on electronics and microcontroller configuration and programming.</p> <p>By the end of this class, you will be able to create and program simple systems that allow coordination of real-world inputs (e.g. pushbuttons, light-level, noise, etc.) with real-world outputs (e.g. lights, sound, motion, etc.). You will also be able to demonstrate how these systems can be used to implement complex behavior in custom-designed systems.</p>
<p>Methods</p>	<p>Class/lab time will consist of synchronous coverage of principles and hands-on activities using Arduino hardware and software. Work outside of class will consist of additional exercises that extend and build upon in-class material. Mastery of concepts will be demonstrated by successful construction and completion of the circuits and code.</p> <p>We will use standardized Arduino starter kits in conjunction with the Arduino Integrated Development Environment (IDE) and Arduino Create programming environments. We will also explore use of the Tinkercad Circuits environment for simulating circuits and block-based programming.</p>
<p>Results</p>	<p>In brief our objectives are to:</p> <ul style="list-style-type: none"> • Develop a foundational familiarity with basic electronics concepts of voltage, current, and resistance. • Develop a basic working knowledge of Ohm’s law • Create connections between observed phenomena and underlying theory • Promote application of knowledge and experience to real-world needs and problems <p>On completion of this course of study, you should be able to:</p> <ul style="list-style-type: none"> • Explain and demonstrate simple circuit construction • Explain and demonstrate fundamental Arduino input and output code constructs • Configure an Arduino microcontroller system to demonstrate basic digital input and output functions • Configure an Arduino microcontroller system to demonstrate basic analog input and output functions • Demonstrate integration of three or more I/O elements into a working prototype

Course Content

➤ COURSE TOPICS

- Basic principles – Voltage, current, resistance and Ohm’s Law
- Characteristics and identification of electronic components including resistors, potentiometers, LED
- Principles and design of very basic circuits (battery, switch, resistor, LED)
- The Arduino Integrated Development Environment (IDE) and Arduino Connect programming environment
- Fundamentals of microcontrollers and a tour of the Arduino platform
- Power management
- Digital outputs - Blink
- Digital inputs - pushbutton
- Programming: I/O constructs
- Analog inputs – analog to digital conversion and bitwidth - potentiometer
- PWM outputs - LED
- Programming: Analog I/O constructs
- Programming: Logic flow – Tinkercad Circuits block programming
- Working with sensors
- Basics of serial interfacing and the I²C bus

➤ COURSE SCHEDULE

The current course calendar is available in Sakai under Resources

Class Essentials

➤ CONTACT INFORMATION

Lead Instructor

Dr. Glenn Walters

 Office Location: 158 Caudill

 Email: walters@unc.edu

 Cell: (919) 451-1750

 Office Hours: TTH 3:30 – 5:00

 Lab Hours

Daily 1:30 – 3:30

BeAM@Murray Hall

➤ LOGISTICS

 Class meeting times

Daily

Wed. 5/19/21 through Mon. 5/24/21

10:00 - noon



Class meeting location

Venable G307 – Ground floor near the Kenan Science Library

 Required Materials

- Arduino Starter Kit
- Laptop Computer running Windows, OSX, or Linux

 Software

- [Arduino Integrated Development Environment](#)
- [Arduino Create web-based development environment](#)
- [Tinkercad Circuits web-based design and development environment](#)

Assignments & Evaluation

➤ YOUR COURSE GRADE	
50% Attendance	This course is fully participatory and attendance is required at all sessions
20% Classroom Exercises	Circuit assembly and programming during instruction
30% Individual Projects	Individual exercises completed outside of class
➤ GRADE INTERPRETATION & HONOR CODE	
Your final course grade will be determined as follows: Pass ≥ 60% Fail < 60%	ACADEMIC HONESTY There will be clear communication if assignments are individual or group. For individual assignments, while I encourage collaboration, it is a violation of the honor code if a student duplicates work or obtains solutions from another student and submits it as their own. Please reference the honor code: http://honor.unc.edu .
➤ STUDENT RESOURCES	
SEE, SAY, DO SOMETHING We're happy you are here and eager to learn. Despite our best intentions to follow a plan, life may throw us a curve ball. If you or someone you know is experiencing some distress or you are concerned about the well-being of a student, please report it here: https://deanofstudents.unc.edu/carereport . It is important to support one another. If you see something, say, and do something.	ACCESSIBILITY RESOURCES UNC-CH provides accommodations for any students with documented disabilities. If you have a disability and believe you require accommodations, please contact the Department of Accessibility Resources at http://accessibility.unc.edu . Please contact me early in the semester so we can make any necessary arrangements and discuss the learning checks.
TITLE IX Resources <i>Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – Adrienne.allison@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.</i>	

➤ COURSE EXPECTATIONS AND POLICIES
<ul style="list-style-type: none"> • Community Standards in Our Course and Mask Use. This fall semester, while we are in the midst of a global pandemic, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. This requirement is to protect our educational community — your classmates and me — as we learn together. If you choose not to wear a mask, or wear it improperly, I will ask you to leave immediately, and I will submit a report to the Office of Student Conduct. At that point you will be disenrolled from this course for the protection of our educational community. An exemption to the mask wearing community standard will not typically be considered to be a

reasonable accommodation. Individuals with a disability or health condition that prevents them from safely wearing a face mask must seek alternative accommodations through the [Accessibility Resources and Service](#). For additional information, see [Carolina Together](#).

- This course is highly interactive and attendance at all sessions is required unless previously arranged with the instructor. Attendance is regularly recorded and is a factor in your final grade.
- In the event of an unavoidable absence (e.g. medical), a written explanation is required. I expect all students to abide by the [UNC Class Attendance Policy](#).
- During class time, do not use your phone or computer for something unrelated to class; research shows that this is distracting to other students in the class. If there is an urgent situation, then you can leave the classroom to use your phone or computer. Unless specifically instructed otherwise, **all electronic devices should be packed away during class.**
- You will be working closely with your classmates and should accord them all of the respect and honor that you yourself expect in return. Our goal is to overcome inhibitions to creativity so it is very important to give and receive critique in an objective and professional manner. There are no bad ideas in this class, just a whole lot of ideas that are part of the pathway to a solution. Remember that the crazy, stupid, and impossible ideas have often been the early steppingstones to world-changing innovation.
- Due dates are given with each assignment. It is expected that assignments be submitted at the beginning of class, on the due date.
- This is a course in engineering fundamentals. As such, there is a need to acquire definitive and quantitative knowledge. Homework assignments allow you to develop and hone the necessary quantitative skill sets and are graded based on problem solving process, format, and content. For project and lab assignments, I primarily use a system known as specifications grading which focuses more on successful completion of assignments rather than quantitative ranking of your work relative to some ideal standard. In this system, I expect you to meet the specifications provided in the rubric to receive points for the assignment. For most such assignments, individual specifications will be assigned point values and points will be awarded on the basis of whether or not each specification is met.
- I also require evidence and documentation of your problem-solving process. For homework problems, we will use the Engineering Homework Format (see handout). For design exercises, we will use an engineering portfolio documentation process which can include sketches, narrative journaling, design files, and photographs. Demonstrated artistic and engineering skills are not primary factors in project evaluation. This does not, however, relieve the student from the obligation to produce neat, well thought-out work.

I reserve to right to make changes to the syllabus, including project due dates and test dates (excluding the officially scheduled final examination), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.