

Physics 320 - Electronics

Syllabus - Fall 2021

Instructor: Dr. Michael Goggin
Office: MG 3002
Research Lab: MG 3147
Telephone: 785-4410
E-Mail: mgoggin@truman.edu

Office Hours*: M 3:00-5:00 PM, T 4:30-5:30 PM
W, 10:30 AM-12:30 PM & 1:30-3:30 PM
Th 11:30 AM-12:30 PM
Also by appointment**
Web Page: <http://www2.truman.edu/~mgoggin>
or <http://mgoggin.sites.truman.edu/>

Please check my webpage for the latest info.

***I will be available either in my office, my research lab, or one of the teaching labs. I will leave a note outside my office indicating where I am.**

****Here “by appointment” means at times that are different from those listed above because of schedule conflicts.**

COVID-19 NOTICE: The Fall 2021 semester is (still) taking place in the middle of a global pandemic. We have experienced our society turned upside down and inside out. In the Spring 2020 semester Truman (and everywhere else) shifted to online instruction due to the pandemic. In terms of number of cases and deaths, the US is worse off now than we were then. But we have learned a lot more about the virus. We have a better understanding of how it spreads and how to minimize that spread. The primary method being as many people as possible getting the COVID-19 vaccine. I hope you are vaccinated.

Consistent with guidance for higher education institutions from the Centers for Disease Control and to help us reduce the possible spread of COVID-19, requirements to wear a mask will follow University-wide policy for all course meetings. While the current mask mandate is in place, you will be expected to keep the covering on at all times while in University buildings. When this class meets or you attend office hours, you will be required to wear a face covering that completely covers your nose and mouth. In the event you arrive to class without a face covering, you will be asked leave until you are able to obtain one and return. In the event that the campus-wide mask mandate is relaxed, individuals who have not been fully vaccinated or have underlying medical conditions that increase their risk for infection are strongly encouraged to wear a mask on campus. Thank you for your help in containing this virus and helping to protect your peers.

Proctorio Online Proctoring If we have to move to online instruction, exams and quizzes may be proctored using Proctorio. Therefore, students will be required to have a webcam (external or built-in) with a microphone when taking an exam or quiz. Students understand that this remote recording device is purchased and controlled by the student and that students should select private spaces for the testing. Students with concerns may discuss the location of an appropriate space for the recordings with their instructor or advisor.

There is a fee that will be charged to you the student at the time of the proctored exam. That fee may be up to \$10 per exam. (Discounts may occasionally be in effect and are not under the control of Truman). The number of times we will need to use the service will depend on when in the semester we move online, should that be necessary. If we have more than one exam left then, you are encouraged to choose the “course fee” model instead of the “individual test fee” model as you pay for the first exam. You will be charged a bundle price equal to two individual exams. Subsequent exams will then be conducted at no additional charge to you. If you choose the individual test fee option, you will be charged each time you take a proctored test.

Proctored exam information will be provided prior to any proctored exam. Be aware you must use Google Chrome to take the exam, install the Proctorio Chrome browser extension (from <https://getproctorio>).

com/), and show an official photo identification (ID). You can use either a valid driver's license, passport, or school ID. For additional information about online proctoring, students may visit the Proctorio Support For Students website (<https://proctorio.com/support>).

There will be more about COVID-19 later in the syllabus.

Course Information

Required Items:

- *Electronics: A Systems Approach, 4th, 5th, or 6th Ed.* by Neil Storey
- A quad-ruled bound lab notebook (You may use the one you used in Advanced Lab or another course, if you have one.)
- Elenco AK-100 Learn to Solder Kit (Available from Amazon.com)
<http://www.amazon.com/Elenco-AmeriKit-Learn-Solder-Kit/dp/B0009Z3JJA>

[**COVID-19 Note:** If we pivot online, I will ask you to purchase the following items or something similar because available models may change abruptly:

- USB oscilloscope <https://www.amazon.com/Hantek-HT6022BE20Mhz-Digital-Oscilloscope-Bandwidth/dp/B009H4AYII>
- Digital function generator <https://www.amazon.com/1HZ-500KHZ-Functional-Generator-Frequency-Counter/dp/B07WFT3679>
- a small component kit to be determined (it will depend on how much of the semester is left but cost at most \$50 and likely much less than \$50)

These would, of course, be for you to keep and use.]

From the Catalog: A strongly laboratory-oriented survey of electronic devices and circuits. Electronic test instruments; passive devices; transistors; operational amplifiers; logic chips. NOTE: Honors Scholar Course. NOTE: This course counts toward the 63-hour Liberal Arts and Sciences (LAS) graduation requirement.

Prerequisite: PHYS 196 with grade of “C” or higher.

General Information: Regardless of the phenomenon being measured, almost all experiments require the manipulation of electronic signals. The electronics course serves two purposes: (1) to help you understand the use and evaluate the performance of electronic equipment used in experiments, (2) to prepare you to design and build electronic equipment for use in experiments. Although these goals may seem only of use for prospective experimentalists, they also prepare a theorist to evaluate the results of experiments. And who knows, you may intend to be a theorist but end up an experimentalist.

The Electronics course is a hands-on, practical introduction to electronics covering DC and AC circuits, diodes, transistors, operational amplifiers, and a brief introduction to digital logic. The approach to electronics taken in this course will be a mixture of physical concepts and design principles. Thus the course will at times appear more qualitative compared to other physics courses.

We cannot begin to scratch the surface of the field of electronics in a one semester course. Rather than cover a few topics in detail you will be exposed to a moderate range of concepts and areas of electronic circuits design. The knowledge you gain will provide a foundation upon which you can build. You should also be equipped to pursue any area of electronics that may interest you in the future. The course will prepare you to understand basic electronic circuits and devices, to read complicated schematic diagrams, and to acquire components for, construct and test your own specialized electronic devices (for research, work, home, etc.) By the end of the course you will be much more comfortable with wiring electronic components together to create a working circuit.

Course Structure: Most of the scheduled class time will be used to build working circuits. You will learn the “theory” of electronics mainly from the textbook and homework. Any time spent lecturing will be to

provide background information for the lab and information complementary to the text. You are responsible for material in the assigned reading as well as the material covered during the class sessions. (This is a natural part of the structure of the course). The lab component is, by far, the most essential aspect of the course. In the lab you will learn to use and understand the basic operation of basic instruments (multimeters, signal generators, oscilloscopes, etc.) and to construct, test and modify basic circuits.

Course Objectives: At the end of the this course the student shall be able to

- construct physical DC and AC circuits involving passive and active components.
- construct and control digital circuits with a variety of functions
- analyze existing circuits to determine their functions
- analyze non-working circuits to correct them (troubleshooting)
- design electrical circuits of moderate complexity
- extract information from electronic component data sheets

Labs: You should be able to finish most labs during one class period. As the semester progresses you will have more involved labs that may take two class periods. Each lab assignment is due *at the beginning* of the next class period after the lab.

The lab period is a time reserved for you to work on your circuits and receive help from me. You are also encouraged to work on the circuits outside of the formally scheduled times if necessary. You may leave your equipment set up between lab periods. You may also ask for help from me at times outside the regularly scheduled time, but be aware that I will not always be able to provide it. Also take note that I will be less inclined to ignore my other work to help you if a) you have not been working during the lab time b) it is the day the lab is due and you are still *just getting started*. **You** are responsible for finishing the lab on time - so do not procrastinate.

There may also be occasional lab Practicals where you must demonstrate the proficient use of an instrument, make an accurate measurement or analyze an electronic circuit.

The lab component is the most important (certainly in terms of the grade you receive). There will likely be occasions when you will need extra time to work on a circuit (outside of the assigned class time). I will make the lab available to you to work independently; this is to be anticipated and is certainly part of the expectations of the course. [**COVID-19 Note:** If we have to pivot to online instruction, you will do the labs at home. You will need to buy a simple oscilloscope and function generator. I have listed suitable models the required materials section above. You will also need some other components but I am still working on options for those.]

Attendance: Attendance is mandatory. This is a hands-on course. As physicists you should know that it is impossible to get your hands on anything when you are not in physical proximity. If you must miss class, I will consider requests for make-up labs on a case-by-case basis. The following are necessary but not sufficient conditions to be allowed to make up a lab: you notified me *before* class that you would be missing and you have a good reason for missing class.

Students with sanctioned absences will not be penalized for being absent, but will be expected to make up any missed work within a reasonable length of time. The professor reserves the right to deem additional absences as unsanctioned once a student has missed 6.67% of class time for sanctioned absences. A list of sanctioned absences can be found in the General Catalog (http://catalog.truman.edu/content.php?catoid=15&navoid=801#Attendance_Policy). Sanctioned absences include serving as a representative of the University at intercollegiate athletic events, professional conferences, academic competitions, field trips for courses, interviews for graduate school or careers, health-related absences (with documentation), and absences covered by Truman's non-discrimination policy. For an absence to be sanctioned, students must notify the professor of scheduled absences during the free add/drop period and as soon as possible for any other absences. Students should also provide the faculty member with written notification of the absence. Arrangements for making up prior work should be made prior to the absence. If the absence is unexpected,

the student should arrange to make up the missed work as soon as possible. An appeal of a faculty member's attendance policy can be made through the University Grade Appeals process (see the General Catalog for details).

Substantive Interaction: Truman policy and federal regulations require that students demonstrate that they are academically engaged in the courses they take. You must meet this requirement within the first calendar week of the semester, beginning at 12:00 am on Monday, 23 August 2021, and ending 11:59 pm Saturday, 28 August 2021. Failure to do so, or to provide an explanation of an extenuating circumstance by that date and time will result in your removal from the course. Under certain circumstances, removal could impact your scholarship eligibility or financial aid. For the purposes of this class, establishing academic engagement requires, at a minimum, attending class and engaging in your labs.

Grades:

- 55 % Lab projects, experiments, Practicals, reports
- 15 % Homework problems
- 30 % Two Exams (Midterm & Final, 15% each)

Laboratory grades: By far the most important aspect of the course will be the lab exercises. You will be expected to finish all of the lab exercises and complete all of the assigned circuits. Grades for these will be given for (1) completion; (2) correct function; (3) required modifications; (4) analysis of the circuit; and (5) written documentation. Most labs have a data sheet for recording your results. The data sheet and your lab notes will provide the documentation required for grading. *See the notes below on the lab notes.* [COVID-19 Note: The lab descriptions and data sheets may be distributed online to minimize trading paper back and forth. I will discuss the details in class.]

Grades on a lab exercise will be reduced for the following reasons: (a) incomplete; (b) not functioning; (c) incorrect or incomplete documentation (i.e., no lab notes); (d) incorrect or incomplete analysis; (e) *excessive* assistance from the instructor. I am quite happy to help you troubleshoot your circuit but you should have already made a reasonable effort to figure it out on your own first. Being able to troubleshoot circuits is an important skill. Troubleshooting, in general, is a skill that will serve you well for the rest of your life regardless of your career path.

Homework: Homework assignments will consist largely of problems from the text and will help you with your theoretical (conceptual & mathematical) understanding of the material. We will cover approximately one chapter every week or two but specific assignments will be made as the course progresses so that I can adjust the pace to the needs of the class.

Exams: There will be a midterm and a final exam covering the entire material covered prior to the exam date. These two exams will cover theoretical (conceptual & mathematical) aspects of the course as covered in the printed materials ("handouts"), lectures, and skills/results/behaviors discovered experimentally in the lab. The emphasis of the exams will be on basic information that you should have at your fingertips in the lab. [COVID-19 Note: If we pivot to online instruction, I may replace the exams with a circuit design project or just cancel the exams and apply the missing grade percentage to the lab and homework grades in a roughly 2 to 1 ratio with the exact amount depending on the number of exams left to take. So if we have already had the mid-term then 10% would be added to the lab percentage and 5% would be added to the homework percentage. These amounts would double if we have not had the mid-term. If we are still meeting in the real world at the end of classes, the final will occur on 24 November 2020 at 1:30 PM.]

Lab Notebook: The lab notes will serve as a technical journal of what you have done in the lab. Do not record lecture notes or homework assignments on notes pages (although you may wish to copy pertinent information from a lecture or handout for reference in the lab). Learning to keep a good lab notebook now will help in the Advanced Lab course where you also will be required to keep a good lab notebook. You may, in fact, use your lab notebook from this class in the Advanced Lab course. Please obey the following rules for keeping records:

- Write neatly - your notebook must be readable by others. Write concisely - avoid large printing/writing, as this will make your information more spread out and less easy to review. But do not write so small as to make your writing unreadable. It is not necessary to have flawless notes! Scratch-outs are fine, as are abbreviations and side notes and even late insertions (just be sure to date a later entry).
- Draw a diagram of the circuit(s) you are building; they should be simple, but with enough detail that you could repeat the entire process with only the lab notes.
- Record changes you make, and results of measurements. Write questions you have and concerns about the results. Make simple tables and/or graphs of the results. They need not be final and graphs are certainly "rough."
- Always provide enough detail that you could repeat the entire process with only the lab notes as source. Remember that there may be several days between lab sessions, so you might want to write a summary of what has been done and what needs to be done for the next time you work in the lab.

Safety: To maintain a safe working environment (for you and the equipment), please **LISTEN** and **FOLLOW** directions. **ASK ME** if you do not understand something. **TURN OFF** power to your circuit when you come to get me to ask me about something. **STOP, TURN OFF THE POWER, AND THINK** if you blow a fuse or trip a circuit breaker on your equipment. There was a reason the fuse blew or circuit breaker tripped. Figure out what that reason was before applying power to the circuit again.



Emergency Procedures: In each classroom on campus, there is a poster of emergency procedures explaining best practices in the event of an active shooter/hostile intruder, fire, severe weather, bomb threat, power outage, and medical emergency. This poster is also available as a PDF at this link: <http://police.truman.edu/files/2015/12/Emergency-Procedures.pdf> .

Students should be aware of the classroom environment and note the exits for the room and building. For more detailed information about emergency procedures, please consult the Emergency Guide for Academic Buildings: <http://police.truman.edu/emergency-procedures/academic-buildings/>

This six-minute video provides some basic information on how to react in the event there is an active shooter in your location:

<http://police.truman.edu/emergency-procedures/active-shooter/active-shooter-preparedness-video/>

Truman students, faculty, and staff can sign up for the TruAlert emergency text messaging service via TruView. TruAlert sends a text message to all enrolled cell phones in the event of an emergency at the University. To register, sign in to TruView and click on the "Truman" tab. Click on the registration link in the lower right of the page under the "Update and View My Personal Information" channel on the "Emergency Text Messaging" or "Update Emergency Text Messaging Information" link. During a campus emergency, information will also be posted on the TruAlert website <http://trualert.truman.edu/>.

Academic Honesty: You are to do your own work on the assessment assignments of the course, e.g. quizzes, tests, and lab reports. It is okay to discuss homework assignments with each other to further your understanding of the material but the work you turn in should be your own version of the solution. In addition, you must learn to properly cite the work of others in your work when appropriate. It is part of scientific writing to cite the work of authors who have preceded your work in a field and whose work directly influences your work. If you have questions about proper citation please ask me before you turn in the report. Plagiarism is using the work of others and claiming it as your own. Plagiarism will be grounds for disciplinary action that may include expulsion from school. Changing your experimental data is scientific misconduct and will result in more severe penalties on the assignment than simply getting the "wrong" answer would.

More information on Truman's policy can be found in the General Catalog (<http://catalog.truman.edu/>) and the Student Conduct Code Section 8.050.1 (<http://policies.truman.edu/policylibrary/student-conduct-code/>).

Credit Hour Justification: The *minimum* investment of time by the average Truman student necessary to achieve the learning goals in this course are not less than six “hours” (300 minutes) of work in the laboratory under the instructors tutelage and a minimum of four hours of out of class student work each week per credit hour awarded. The outside work consists of readings and problem sets that present the underlying theory for the laboratory work and troubleshooting difficulties encountered doing the labs. In many ways the teaching model is similar to what is now called a “flipped” classroom. This average time per week for an average, the student may have weekly variations.

Disability Services: To obtain disability-related academic accommodations students with documented disabilities must contact the course instructor and the Office of Student Access and Disability Services (OSA) as soon as possible. Truman complies with ADA requirements. For additional information, refer to the Office of Student Access and Disability Services website at <http://disabilityservices.truman.edu/> You may also contact OSA by phone at (660) 785-4478 or email <mailto:studentaccess@truman.edu>

Title IX: Truman State University, in compliance with applicable laws and recognizing its deeper commitment to equity, diversity and inclusion which enhances accessibility and promotes excellence in all aspects of the Truman Experience, does not discriminate on the basis of age, color, disability, national origin, race, religion, retaliation, sex (including pregnancy), sexual orientation, or protected veteran status in its programs and activities, including employment, admissions, and educational programs and activities. Faculty and staff are considered “mandated reporters” and therefore are required to report potential violations of the University’s Anti-Discrimination Policies to the Institutional Compliance Officer.

Title IX prohibits sex harassment, sexual assault, intimate partner violence, stalking and retaliation. Truman State University encourages individuals who believe they may have been impacted by sexual or gender-based discrimination to consult with the Title IX Coordinator who is available to speak in depth about the resources and options. Faculty and staff are considered “mandated reporters” and therefore are required to report potential incidents of sexual misconduct that they become aware of to the Title IX Coordinator.

For more information on discrimination or Title IX, or to file a complaint contact:

Institutional Compliance Officer, Title IX and Section 504 Coordinator
Office of Institutional Compliance
Violette Hall, Room 1308
100 E. Normal Ave
Kirksville, MO 63501
Phone: (660) 785-4354
<mailto:titleix@truman.edu>

The institution’s complaint procedure can be viewed at <https://wp-internal.truman.edu/provost/files/2020/11/Truman-State-University-Complaint-Reporting-and-Resolution-Procedure9.2020.pdf> and the complaint form is accessible at <http://titleix.truman.edu/make-a-report/>.

FERPA: Education records are protected by the Family Education Right to Privacy Act (FERPA). As a result, course grades, assignments, advising records, etc. cannot be released to third parties without your permission. There are, however, several exceptions about which you should be aware. For example, education records can be disclosed to employees or offices at Truman who have an “educational need to know”. These employees and offices may include your academic advisor, the Institutional Compliance Officer, the Registrar’s Office, or Student Affairs depending on the type of information. For more information about FERPA, see <http://www.truman.edu/registrar/ferpa/>.

Disruptive behavior: “Behavior that persistently or flagrantly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students’ ability to learn and an instructor’s ability to teach. A student responsible for disruptive behavior may be asked to leave class pending discussion and resolution of the problem and may be reported to the Office of Student Conduct.” (*From Washington State University, suggested by Lou Ann Gilchrist*).