Course Syllabus

18-100: *Introduction to Electrical and Computer Engineering*

Spring 2025

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Course Web Page:
We will use the Canvas system for our Web Page this semester. You should attempt to access the page as soon as possible to ensure that you have access to the course materials.
http://www.cmu.edu/canvas/

Students are responsible for any information conveyed via announcements made in lecture and/or on the course web page. Absence from class the day of an important announcement does not excuse you from being responsible for that information.

Course Information:

Number of Units:	12
Co-requisite:	21-120 (you can take before or while taking 18-100)
Course Designation:	18-100 is a required course for ECE majors
Undergraduate Course Area:	ECE Core

Course Description:

The goals of this introductory engineering course are:

- To introduce a broad spectrum of electrical and computer engineering sub-disciplines in an integrated manner;
- To communicate the foundational abstractions underlying electrical and computer engineering as a discipline;
- To motivate basic concepts in the context of real applications;
- To illustrate the process of thinking about problems and creating solutions;
- To inspire students for embracing future challenges, and;
- To prepare students by building the basic understanding and enthusiasm for higher level classes in all areas of electrical and computer engineering, such as the next-tier core courses 18-213, 18-220, 18-240, and 18-290.

The coverage of the course lectures and labs specifically includes: basic electric and electronic circuits, computer digital logic, registers, memories, and CPUs, computer system architecture, embedded systems, CMOS technology, LED technology, filters, amplifiers, digital-analog conversion, wireless/wired digital communication, computer networks, cryptography and cyber security, data storage technology and data centers, and machine learning.

Students are introduced to the above topics not only through lectures, but also through hands-on experience of constructing, testing and analyzing a series of carefully designed small electronic and software "ECE systems" labs. Specifically, these labs cover:

Lab 1: Circuits – Electrical measurements; LEDs

Lab 2: Adder – Gate-level digital logic; binary adder circuits

Lab 3: MOSFET – Transistor-level logic; latching circuits

Lab 4: Signals – Timing circuits and signal generation

Lab 5: Op Amp – Operational amplifier circuits; oscilloscopes and signal generators

Lab 6: Serial – I^2C serial communication

Lab 7: ADC – Frequency response of passive filters, sample-and-hold circuits

Lab 8: Radio – Amplitude modulation; wireless communication circuits

Lab 9: Crypto and Cloud – Cryptography and IoT Cloud Integration

The above labs are matched with the lecture series to consolidate the comprehension of the course material through practical hands-on and thought-provoking experiences. Along with the lecture materials, these labs should strengthen the fundamentals demanded by the next tier courses on analog devices and circuits (18-220), digital logic and computation (18-240), signal analysis and processing (18-290) and computer systems (18-213).

In addition, an effort is included in this course to help familiarize all students with some of the specialized vocabulary that is often employed in the field of ECE. An additional goal of this course is for students to establish qualitative intuition about how electrical and computer systems operate in preparation for detailed quantitative analysis to be developed later in the ECE core.

Reference Textbook:

There is no reference text. Lecture notes will be provided.

Lab Materials:

Students will receive all materials needed for all the labs. Handouts for Lab will be posted on the course canvas website one week prior to their due date.

Two of the devices, ADALM 2000 and a Raspberry Pi Pico in the lab materials that you will receive, require the use of a personal computer, either Mac or PC, ***with at least two USB-A ports***. We will use them starting in Lab 4.

Course Meeting Info:

Lectures: **Mondays and Wednesdays 12:30pm-1:50pm HOA 160**

Lectures are a critical part of this course. We do not have a textbook that is closely followed in this course. Therefore, your timely comprehension on any given topic are extremely important. Lecture slides and notes will be posted the day before each lecture on Canvas. They will remain available on Canvas throughout the semester.

Recitations and Small Groups:

Small groups, listed on the University schedule as the Sunday afternoon or Monday evening meetings are mandatory and graded. You must attend the small group at the time and location for which you are registered. Small group meetings involve groups of five (5) students facilitated by two (2) TAs, and focus on hands-on learning and skill-building.

Lab Kits

Each student will receive a lab kit containing all the components, materials, and test equipment necessary to complete all of the labs. Lab equipment will be distributed during the first week of classes, and lab exercises are designed to be completed anywhere (at home, TechSpark, etc.)

Course Activities:

To help students assess how well they are understanding the material presented in class, there are a number of course activities that provide feedback on progress.

Exams:

The course lectures are broadly divided into three sections. At the end of each section, there will be an Exam covering primarily the material presented in that section. There will not be a cumulative final exam in this course although materials from previous section(s) may still appear on a given exam due to natural dependencies. The first two exams are during regular lecture time slots. The third exam is during the final exams period.

All exams are to be taken during the scheduled exam date and time. Make-up exams are highly discouraged. If you are unable to take an exam at the scheduled time (for a valid reason), you must contact one of the instructors preferably one week prior to the originally scheduled. Make-up exams may or may not be possible, but some reasonable accommodation will be made.

If you have special circumstances approved by the Disabled Student Services office, please make arrangements with the instructors at least 72 hours before the scheduled exam time.

Quizzes:

A multiple-choice style quiz will be given at the end of each lecture using the quiz platform on Canvas. Each quiz usually consists of three problems and these quiz problems serve the purpose of reviewing the lecture material just presented. Students need to finish each quiz by 10 pm the next day **and no extensions will be granted for quiz due dates**.

Homework:

Doing homework assignments is the best way to reinforce understanding of the material being covered in class. Homework will be submitted via Gradescope. You will upload a scan (pdf) or photo (jpg) of your solution to each problem.

You may work together on mastering an understanding of each of the homework problems; that is, learning how to set up the equations that embody the homework problem and learning how to solve them. **However, the actual written solutions to the problems that you upload to Gradescope must reflect your own understanding.** You should NOT submit someone else's solutions. You should NOT just copy someone else's solutions and submit them. Furthermore, artificial intelligence text generators such as ChatGPT should not be used to directly produce answers to questions on assignments. These actions constitute cheating and will be reported to the Academic Integrity office when caught. You are strongly encouraged to make sure you can do each problem by yourself independently.

Laboratory:

Each lab requires an independent in-person demonstration of the circuits or systems that each student has constructed and their function to his/her designated TA along with explanations and ability to answer questions. Students should keep their circuit wiring neatly so that it is easy to assess. Messy circuit wiring may affect adequate assessment of your building work, impacting your lab grades in an unwanted way.

Your lab grade will consist of the following two components:

1) Answers to all questions listed in your lab handout. These must be completed by each student individually and **submitted online through Gradescope by 10 pm on Thursday of the lab due week**.
2) In-person demonstration of the required functions of the constructed circuit/system or/and the functional program. This can be demonstrated to any TA during open lab hours.

Do your own work! See the Academic Integrity section for more details.

Late Policy:

Late homework and labs are accepted up to three days late – but there is a 10% late penalty per day. **We do not accept assignments more than 72 hours** because we need to publish solutions in a timely manner. Submissions beyond 72 hours late will automatically receive a zero. Should you need additional time, please speak with your group TA at least 24 hours in advance. Depending upon the circumstances, extensions and/or reduced late penalties *may* be possible.

Grading Policy:

Your grade will be calculated using the following method:

5%	Quizzes (lowest 5 scores dropped)
5%	Small Group Attendance
15%	Homework (lowest 1 score dropped)
45%	Lab (no drops)
30%	3 Exam Scores (each exam is 10% of the course grade)

While lower cutoffs may be used, the following cutoffs are guaranteed:

>=90	A
>=80	B
>=70	C
>=60	D

Re-grades:

You have 1 week from the time an exam, quiz or lab assignment is available on Gradescope to ask for a re-grade. Unless instructed otherwise, all regrade requests must be made via Gradescope.

Attendance:

Attendance is *expected* at all lecture, recitation, and lab sections. Attendance at small group meetings is mandatory.

Any in person meeting associated with the class, whether group or individual, requires complaince with the University's guidelines, i.e. "Tartan's Responsibility":

- https://www.cmu.edu/coronavirus/students/tartans-responsibility.html

Tentative Course Calendar:

See Canvas.

Academic Integrity

Please review the University Academic Integrity policy, which applies to this class:

- https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html

It is important to understand that all assignments are to be done individually, unless you are explicitly asked to work with others.

Please note that you are neither allowed to receive unauthorized assistance – nor to give it. You are required to take reasonable measures to ensure that no one copies your solutions to homework or lab questions, studies your lab designs or solutions, or copies or your breadboard, etc.

Please also note that the Academic Integrity policy can be applied retroactively, which means you can be penalized after the class is over, even after graduation.

The course-level penalty for an Academic Integrity Violation often ranges from a -100% score on the assignment to an "R" grade for the course. Should you make a mistake, and realize it before the course staff does, please speak to a member of the course staff. It is possibly that you will be permitted to withdraw the affected work, thereby avoiding any penalty (but not earning points on the withdrawn work).

AI Tools:

- AI tools, such as, but not limited to, ChatGPT and Co-Pilot **may** be used to get help with understanding lecture material, provided examples, spec sheets, general background, and further exploration.

- AI tools, such as, but not limited to, ChatGPT and Co-Pilot, may **not** be used to get partial or complete solutions to any portion of any assignment, or to get explanations or instructions for completing any assignment, e.g. you cannot ask ChatGPT to design any portion of a circuit for you, or for the answer to a question proximal to a homework question.

- In general, you may use AI tools for help **understanding** course material of any kind, but you may **not ask it to generate anything** toward any assignment, e.g. code, steps, portions of circuits, special cases, answers, etc.

- Please keep in mind: Responses you receive from an AI tool may well be attributable to publicly accessible materials and not properly cited by the AI tool, they may be given to other students in response to their queries, and they may be incorrect, inapplicable, or incomplete. En caveat emptor. You, not your tools, are wholly responsible for your submissions.

- Please treat responses from AI Tools as if they came from a person or a published work and **cite them to the AI Tool in any case where you would cite the contribution should it have been made by a person or have come from a published work.**

Diversity Statement

We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can

share these experiences using the following resources:

- Center for Student Diversity and Inclusion: csdi@andrew.cmu.edu, (412) 268-2150
- Report-It online anonymous reporting
  platform: reportit.net username: *tartans* password: *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

Taking Care of Yourself

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is almost always helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website athttp://www.cmu.edu/counseling/. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

Education Objectives (Relationship of Course to Program Outcomes):

The ECE department is accredited by ABET to ensure the quality of your education. ABET defines 7 Educational Objectives that are fulfilled by the sum total of all the courses you take. The following list describes which objectives are fulfilled by 18-100 and in what manner they are fulfilled. The objectives are numbered from "1" through "7" in the standard ABET parlance. Those objectives not fulfilled by 18-100 have been omitted from the following list.

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics: The course poses many problems; on homework, in labs, during exams, and for in-class exercises; for the student to formulate and solve using good engineering practice.

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors: The course is an introduction to the discipline of electrical and computer engineering in a broad context, covering numerous applications. Regulatory concerns regarding wireless communications and the use of electromagnetic spectrum resources will be discussed in lecture and the lab manual.

(3) An ability to communicate effectively with a range of audiences: Students will practice their communication skills during circuit demonstrations to small groups of

other students and teaching assistants. Written communication of problem solutions is also included on homework, laboratory write-ups, and exams. The audiences communicated to are primarily engineers in this introductory course.

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. Small groups of 5 students will work closely with a teaching assistant in laboratory, and will be encouraged to help each other debug their circuits in a multidisciplinary makerspace.

(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions: Students build circuits and perform experiments to characterize them in laboratory. Students will analyze data and electrical measurements throughout the debugging process in each laboratory exercise.