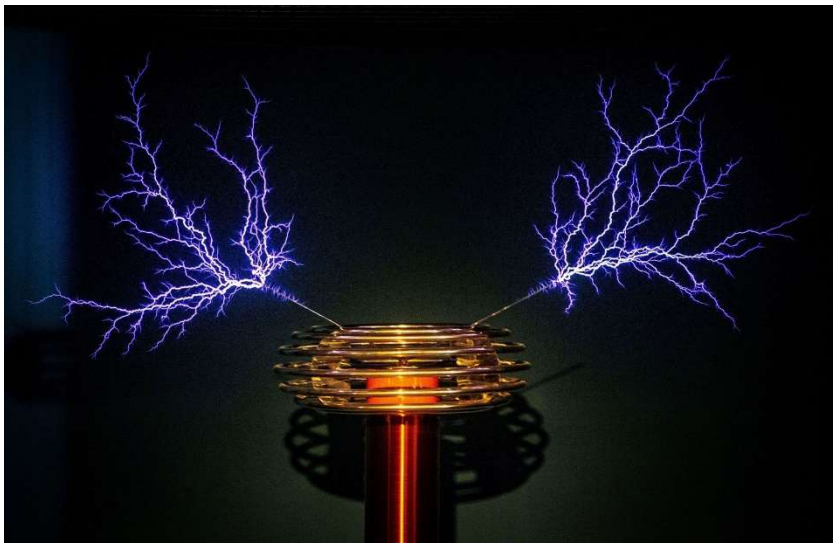
NC STATE UNIVERSITY

ECE 526 Course Syllabus

Advanced Analog Electronics Laboratory

Fall 2025



Instructor Information

Professor David Ricketts

- Office Phone: 919-513-7361
- Email: dricket@ncsu.edu or david.ricketts@ncsu.edu
- Office Location: Monteith Research Center, 450

Office Hours

Instructor: Office hours are in studio on Fridays or by appointment.

TA: Posted on Moodle

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Preferred Method of Communication & Response Time

- **Preferred method of communication:** If you need to contact me directly, my preferred method of communication is email. You can expect to receive a response within onebusiness days (i.e. not over the weekend). If I email you directly, please strive to respond within two business days. It is recommended that you check your NC State email at least once a day to stay on top of course communications.
- **Asking questions about the course:** If you have a question about the course or its content, you can post your question on the Student Help Forum in Moodle. If you are uncomfortable with using the forum, you can also email me.
- **Email guidelines:** Always include a descriptive, specific but concise subject. Include your course number and section in your email and provide adequate context for your question in order to ensure full understanding of your email. Be sure to use your NC State email account and sign in with your name and Student ID number.

Course Information

Course Website: https://moodle-courses2324.wolfware.ncsu.edu/course/view.php?id=2809&bp=s

Meeting Time and Location: 12:50 p.m. – 3:35 p.m., EB2 1032

Course Credit Hours: 3

Catalog Description

A hands on laboratory based course where students work in teams to construct a semester long project. The course focuses on analog and digital electronics, including: radio frequency circuits, micro-controllers and programming, digital logic, control systems, operational amplifiers and their applications in integrators and differentiators as well as active filters, oscillators, various classes of amplifiers, PID controllers, regulators, and power supplies etc. Projects change each semester and are selected by the instructor.

An Exemplar project is students build a Tesla coil from scratch. The design includes: power management circuits, power electronics, analog signal [processing, 3D printing and mechanical assembly, electromagnetic design of coils and capacitors, micro-controller coding and control algorithms.

Structure

The majority of this course is **synchronous**, delivered through real-time, face-to-face class sessions of Fridays. Additional materials and activities are delivered through **Moodle**, a secure and easy-to-use online learning platform.

Learning activities in this course will include homework's, lectures, and a group design project. The first half of the course consists of 60-120 minute lectures each Friday. The lecture slides will be available on Moodle each week. Each week has a homework assignment based on the lecture material, which is peer-graded. You will receive two homework assignments to peer-grade, and similarly, two of your peers will grade your assignment. You get points for grading your peers only if you include feedback for any points

deducted. If you give full credit, instructors will assess the grading to confirm it. Remember that two people grade each assignment, and the points given will be compared.

The second half of the course is dedicated entirely to the final project. The class time on Fridays will be dedicated to lecture and group design of their project.

Meeting Time and Tool Used

Meeting time are Fridays from 12:50 pm to 3:35 pm in-person. Lectures and presentations will be recorded via Zoom, and the recordings will be available via Panopto.

Prerequisites/Corequisites

ECE 302 Microelectronics

Minimum Technical and Digital Information Literacy Skills

Required technical skills:

- Navigate and use Moodle, NC State's Learning Management System.
- Use Gmail, including attaching files to email messages.
- Create and submit files in commonly used word processing program formats (MS Word, text editors, Google Docs).
- Download and upload attachments.
- Use spreadsheets, presentations, graphics programs, and other applications in digital environments.
- Use web conferencing tools including Zoom.
- Post to discussion boards and forums.
- Use Cadence Virtuoso via the ECE Linux Systems to simulate circuits.

Required digital information literacy skills:

- Perform online research using various search engines and library databases. Visit Distance Learning Services at NC State Libraries for more information.
- Use computer networks to locate and store files or data.
- Use online search tools for specific academic purposes, including the use of search criteria, keywords and filters.
- Analyze digital information for credibility, currency, and bias (e.g... disinformation, misinformation)
- Properly cite information sources.
- Prepare a presentation on research findings.
- Prepare a presentation on project progress, and present to the class

General Education Program (GEP) Information

GEP Category Fulfilled

None. This course does not fulfill and GEP category.

GEP Corequisites

None

Learning Outcomes

Upon completion of this course, students will be able to:

1. Design and analyze operational amplifier circuits and filters.
2. Design and analyze pulse-width modulators and oscillators
3. Design discrete transistor circuits, such as class A-D amplifiers
4. Understand radio frequency transmission
5. Design and model electromagnetic components
6. Design and code a proportional-integral-differential controller in a microcontroller
7. Design, assemble and test a circuits on a printed circuit board.

Course Materials

Required textbook

None.

Other required materials

Students must come to each class with their Analog Discovery 2.

Other course materials, notes, and studio assignments on Moodle

Optional materials

This textbook is an excellent resource for general analog circuit design.

Horowitz, Paul and Hill, Winfield. The Art of Electronics, 3rd ed. ISBN: 978-0-521-80926-9

Technology Requirements

NC State University Libraries offers Technology Lending, where many devices are available to borrow for a 7-day period. Computer labs are available in various locations around campus for student use.

Computer

A laptop computer is recommended for students taking this course. NC State's Online and Distance Education provides technology requirements and recommendations for computer hardware, and NC State's Office of Information Technology provides recommendations for your computer at NC State.

Other devices

Analog Discovery 2 – students should have this from their previous ECE courses

Software and digitally-hosted course components

The following software and tools will be used in this course. Some tools are a part of NC State's enterprise tools. See information about their purpose, how to access them, accessibility information, and privacy policies. The same information for any other tools required in this course is provided in the list below.

- LTspice for circuit design and simulation. Maxwell 3D electromagnetic simulator. This will be available through the ECE Grendel servers, and documentation for access is provided in a step-by-step guide on Moodle.

Other Student Expenses

- Parts for course project. Estimated at $150 per student.

Communication Guidelines

Respecting our learning community

The NC State Code of Student Conduct outlines expectations for behavior in the classroom (whether virtual or physical) and the consequences for students who violate these expectations. Any behavior that impacts other students' ability to learn and succeed will be addressed, but expressing diverse viewpoints and interpretations of course content is welcome.

Community guidelines for this course include:

- Use a respectful tone in all forms of communication (email, written, oral, visual)
- Maintain professionalism (avoid slang, poor grammar, etc.) in your written communication.
- Respect regional dialects and culturally embedded ways of oral communication.
- Stay home or in your dorm room if you are exhibiting symptoms of a contagious illness (fever, chills, etc.).
- Enter our virtual and/or physical classroom community respectfully by refraining from lewd or indecent speech or behavior, helping to maintain a safe physical environment, not using your cell phone for voice or text communication except when explicitly given leave to do so, and not attending class under the influence of any substance.
- Treat each community member with respect by not recording others without their consent or engaging in any form of hazing, harassment, intimidation, or abuse.
- Respect cultural differences that may influence communication styles and needs.

Expectations for learner participation and interaction

Some course activities including synchronous class sessions, Moodle Forums, and group work will require you to interact with other students in the course. Communication expectations including frequency and content are detailed in the information about each assignment or activity when it appears

in the course. You are encouraged to engage in forum posts, and to discuss technical ideas with other students in the class.

Grading and Feedback

Grading criteria, details, and timing of feedback

Percentage of grade	Component	Details and timing of feedback
60 %	Labs (in class)	• One lab per week for first 8 weeks. Grading is done through peer-review, and grades will be released within a reasonable time after submissions are due.
40 %	Project	• Project done in group of two. Students will have approximately 7 weeks to complete the project. Weekly instruction is provided during those 7 weeks..

*modifications to the timing of grades/feedback, if required, will be announced via Moodle. Ensure you are subscribed to email notifications to stay up to date.

Grading scale

This course grading system is shown in the table below. Students grades will be calculated based on class curve. If the curved grade is higher than the guaranteed score, the student will receive the higher curved grade. If the Guaranteed grade is higher, the student will receive the guaranteed grade.

Grade	Guaranteed	Curve Distribution
D	>63	$<\mu-3\sigma$
C	>70	$\mu-2\sigma$ to $\mu-3\sigma$
B-	>80	$\mu-1.5\sigma$ to $\mu-2\sigma$
B	>83	$\mu-1\sigma$ to $\mu-1.5\sigma$
B+	>87	$\mu-1/2\sigma$ to $\mu-\sigma$
A-	>90	$\mu\pm1/2\sigma$
A	>93	$\mu+1/2\sigma$ to $\mu+1\sigma$
A+	>97	$\mu+1\sigma$ +

μ is mean; σ is standard deviation. Grades rounded to one significant digit, i.e. 90.149 is 90.1. Thresholds represent transition to next grade: $\mu-1/2\sigma$ is an A-, $\mu+1/2\sigma$ is an A. Algorithm may change if non-Gaussian distribution or if performance of class is well above/below standard.

Requirements for earning a grade of “Satisfactory”

If you are taking this course for credit only (S/U), your grade will be reported as S (Satisfactory) when you have completed all the homework with a passing grade, otherwise U (Unsatisfactory). For more information, see the Credit Only Courses regulation.

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Requirements and procedures for auditing this course

This course involves significant group activities. Auditing is not approved for this course..

Course Schedule

Please note: the course schedule is subject to change.

Week	Component	Concept	Other Notes
1	Interrupter	System Overview, Breadboarding, & Layout	Coil Winder Appointments Open
2	Interrupter	Soldering & Troubleshooting	
3	DRSSTC Driver	Digital Logic, Feedback, & ZCS	
4	DRSSTC Driver	Buffers & Protection Circuits	
5	Power Bridge	Transformer Types & Considerations	
6	Power Bridge	Rectifiers, Half-Bridge, & Thermal Management	
7	Mechanical	CAD & 3D Printing	
8	Primary Coil + MMC	Impedance Matching, Q Factor, & Coupling	
9	Secondary Coil + Top Load	Resonance Measurements & Physical Effects	
Spring Break – No Class			
10	Circuits + Primary	Bench Testing	
11	Circuits + Primary	Bench Testing	
12	Primary + Secondary	Tuning	
13	Final Assembly	Final Assembly + Demo Prep	
14	Final Assembly	Final Assembly + Demo Prep	

Course Policies

Late assignments

Late assignments will not be accepted, since the course uses automatic timing. All assignments can be done anywhere in the world with internet access and a laptop, which is part of the basic requirements for this course. Additionally, all assignments are available early on so that you can plan ahead and complete assignments before the due date.

If you have an unforeseen event that is approved by the University for consideration, please see the professor in person and bring documentation. This would be a death in your immediate family, a serious illness of multiple days with a doctor's note or a natural disaster, etc.

Students honoring religious holidays can do assignments early. Students who need more time to complete can do all assignments early and already have extra time since the assignments can be done outside of class.

Incomplete grades, withdrawals

Information on incomplete grades can be found at REG 02.50.03 – Grades and Grade Point Average. If you encounter a serious disruption to your work not caused by you and you would have otherwise successfully completed the course, contact your instructor as soon as you can to discuss the possibility of earning an incomplete in the course for the semester, including an agreement on when the remaining work must be done in order to change the grade to the appropriate letter grade. If you must withdraw from a course or from the University due to hardship beyond your control, see Withdrawal Process and Timeline | Student Services Center for information and instructions.

Attendance

- Attending lectures is required, as well as attending group presentations. Accommodations will be attempted for online attendance via Zoom, but in-person is preferred.
- If you cannot attend, please contact me to state why. Excuses for unanticipated absences must be presented to the instructor within one week after the return to class.

Related NC State Policy: REG 02.20.03 – Attendance Regulations

University Policies

Academic integrity and honesty

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct 11.35.01 sections 8 and 9. Therefore, students are required to uphold the Pack Pledge: "I have neither given nor received unauthorized aid on this test or assignment." Violations of academic integrity will be handled in accordance with the Student Discipline Procedures.

Please refer to the Academic Integrity web page for a detailed explanation of the University's policies on academic integrity and some of the common understandings related to those policies.

Student privacy

Originality Checking Software

Software is not used in this course to detect the originality of student submissions.

Class recording statement:

In-class sessions are recorded in such a way that will likely also record students in this course. These recordings MAY be used beyond the current semester or in any other setting outside of the course. Contact your instructor if you have concerns.

Class privacy statement:

This course requires online exchanges among students and the instructor, but NOT with persons outside the course. Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web postings, where relevant to the course. Examples include online discussions of class topics and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Other Policies

Students are responsible for reviewing the NC State University PRR's which pertain to their course rights and responsibilities:

- Equal Opportunity and Non-Discrimination Policy Statement and additional references
- Code of Student Conduct
- Grades and Grade Point Average
- Credit-Only Courses
- Audits

Student Resources

Academic and Student Affairs maintains a website with links for student support on campus, including academic support, community support, health and wellness, financial hardship or insecurity, and more. Find Help on Campus.

Disability resources

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office (DRO). For more information on NC State's policy on working with students with disabilities, please see the Policies, Rules and Regulations page maintained by the DRO and REG 02.20.01 Academic Accommodations for Students with Disabilities.

Safe at NC State

At NC State, we take the health and safety of students, faculty and staff seriously. The Office for Institutional Equity and Diversity supports the university community by providing services and resources to support and guide individuals in obtaining the help they need. See the Safe at NC State webpage for resources.

Supporting Fellow Students in Distress

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remain a healthy and safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you, either for the classmate's well-being or yours. If you feel this way, I would encourage you to report this behavior to the NC State CARES website. Although you can report anonymously, it is preferred that you share your contact information so they can follow up with you personally.

Course Evaluations

ClassEval is the end-of-semester survey for students to evaluate the instruction of all university classes. The current survey is administered online and includes 12 closed-ended questions and 3 open-ended questions. Deans, department heads, and instructors may add a limited number of their own questions to these 15 common-core questions.

Each semester students' responses are compiled into a ClassEval report for every instructor and class. Instructors use the evaluations to improve instruction and include them in their promotion and tenure dossiers, while department heads use them in annual reviews. The reports are included in instructors' personnel files and are considered confidential.

Online class evaluations will be available for students to complete during the last two weeks of the semester for full-semester courses and the last week of shorter sessions. Students will receive an email directing them to a website to complete class evaluations. These become unavailable at 8 am on the first day of finals.

- Contact ClassEval Help Desk: classeval@ncsu.edu
- ClassEval website
- More information about ClassEval

Syllabus Modification Statement

Our syllabus represents a flexible agreement. It outlines the topics we will cover and the order in which we will cover them. Dates for assignments represent the earliest possible time they would be due, but extensions are at the discretion of the instructor. The pace of the class depends on student mastery and interests. Thus, minor changes in the syllabus can occur if we need to slow down or speed up the pace of instruction.