

Course: EE223
Title: AC Circuits

Term: Spring 2026

Credit hours: 4

Meeting days/time/location:

Lecture (All sections): 11AM—12:15PM, Tuesday and Thursday, 323 RMB

Lab: Section-001 8:00AM—10:50AM, Tuesday, 465FPAT

Section-002 3:30PM—6:20PM, Tuesday, 465FPAT

Section-003 2:00PM—4:50PM, Wednesday, 465FPAT

Section-004 2:00PM—4:50PM, Thursday, 465FPAT

Instructor Information

Name: Caicheng Lu

Email: cclu@uky.edu

Office building and room number: FPAT, room 693

Office phone: (859) 257-1644

Office hours: 2:00PM—3:00PM, Tuesday

Preferred method of communication: EMAIL

TA information

TA1: Name: Samiha Tahsin

Email: samiha.t@uky.edu

TA2: Name: Sania Eskandari

Email: sania.eskandari@uky.edu

Course Description

Analysis and design methods for analog linear circuits whose elements consist of passive and active components used in modern engineering practice, including power, transfer functions, network parameters, and a design project and laboratory experiments involving modern design practices.

Course Prerequisites

EE211; Prerequisite or Concurrent: MA214

Required Materials

Textbook: Fundamentals of Electric Circuits, 7th Edition, Charles K. Alexander and Matthew N. O. Sadiku, McGraw Hill Education with McGraw-Hill Connect License for Canvas, ISBN 978-1-260-22640-9 (You will access the textbook from Canvas, **there is no need to purchase a hard copy**).

Lab Kit: A lab notebook is recommended (A preferred lab notebook shall be ruled and can produce duplicate pages). You also need to have a parts kit (a list of parts will be provided separately on CANVAS).

Circuit Simulation Software:

You will use LPspice (currently, free to download and use) or Multisim for circuit simulation (Use of Multisim is optional, there may be a fee charged by the publisher). The link to download LTspice is <https://ltspice.analog.com/software/LTspice64.msi> (If this link does not work, you may also search LTspice for other links. It shall be free to download and free to use).

Associated Expenses

There are no additional costs due to course requirements (except for the textbook mentioned above).

Activities Outside of Regular Class Meetings

No other required regularly scheduled activities for this course (there may be occasional announcements encouraging you to attend certain events, such as ECE Senior design presentations, on a voluntary basis).

Skill and Technology Requirements

Computer literacy and programming skills commensurate with Engineering Standing in EE or CPE. It is expected that students be able to write computer programs to solve some problems (examples include MATLAB scripts). Sample programs and codes will be provided.

Sample optional text for ITS Support:

For technical assistance, contact ITS Customer Services 24/7 at 859-218-HELP (4357) for urgent needs. For non-urgent matters, visit the ITS web page at <https://its.uky.edu/> or submit a: [Customer Services Assistance Request form](#).

Student Learning Outcomes

After completing this course, the student will be able to:

- 1) Perform AC steady-state power analysis on single-phase circuits.
- 2) Perform AC steady-state power analysis on three-phase circuits.
- 3) Analyze circuits containing mutual inductance and ideal transformers.

- 4) Derive transfer functions (variable-frequency response) from circuits containing independent sources, dependent sources, resistors, capacitors, inductors, operational amplifiers, transformers and mutual inductance elements.
- 5) Derive two-port parameters from circuits containing resistive and impedance circuits.
- 6) Use software to compute circuit voltages, currents and transfer functions.
- 7) Describe a solution with functional block diagrams (top-down design approach).
- 8) Work as a team to formulate and solve an engineering problem.
- 9) Use computer programs (such as MATLAB and Multisim) for optimizing design parameters and verifying design performance.

Course Details

Topics and Tentative Course Schedule (Lecture part)

Topics	Chapters	Tentative Schedules
Review of AC circuits	9, 10	Jan. 13, 15
Single Phase AC Power	11	Jan. 20, 22, 27, 29
Networks, transfer functions	14,	Feb. 3, 5, 10, 12
Resonant circuits, op amp	14, 19	Feb. 17, 19, 24, 26
Circuits, filters, two-port networks	Mar. 3, 5, 10, 12 (MidTerm)	
Mutual Inductances and Transformers	13	Mar. 24, 26, 31, Apr. 2, 7, 9
Three-phase Circuits and Power	12	Apr. 14, 16, 21, 23, 28

Course Activities, Assignments, Exams (Lecture part)

Lecture assignments include: in class quizzes (on randomly selected dates), homework (on weekly base), midterm exam (split into Test1 and Test 2), and a final exam.

Homework assignments include two parts: one part consists of selected end-of-chapter problems from textbook, and the other part consists of problem solving using computer software (MATLAB and LTspice).

Midterm Exam: 11:00AM—12:15PM Thursday, Mar. 12

Final Exam: 10:30AM—12:30PM Thursday, May 7

Topics and Tentative Course Schedule (Lab)

Lab #	Lab Dates	Lab Topics and Report Requirement (TM or FR)
Lab-1	Jan. 20, 21, 22	DC voltage and current measurements (TM)
Lab-2	Jan. 27, 28, 29	Non-ideal source and meter (TM)
Lab-3	Feb. 3, 4, 5	Thevenin and Norton equivalent circuits (TM)
Lab-4	Feb. 10, 11, 12	Measurements of time constants, phase angles (TM)
Lab-5	Feb. 17, 18, 19	RLC resonant circuit (TM)
	Feb. 24, 25	Makeup Lab-2 for Sections (01, 02, 03)
	Mar. 10, 11, 12	Midterm practical
Lab-6	Mar. 24, 25, 26	Complex power and maximum power transfer (FR)
Lab-7	Mar. 31 Apr. 1, 2	Op Amp circuit basic measurements (TM)
Lab-8	Apr. 7, 8, 9	Op Amp circuit frequency response (TM)
Lab-9	Apr. 14, 15, 16	Op Amp circuit application: Audio Filter design (FR)

	Apr. 21, 22, 23	Final practical
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Lab Assignments

There are four assignments for each lab. These assignments are described below.

- (a) Pre-lab: questions related to topics of the next lab and must be completed and submitted (on to CANVAS) before the start of your lab section (this means students in different sections have different due dates and due times).
- (b) Lab-notes: You will take notes during the lab experiments and submit to CANVAS at the end of your lab section. A lab is performed in teams (up to 2 per team).
- (c) Lab-quiz: questions are related to the previous lab and mostly in-class.
- (d) Lab-report: A report for a lab in the form of TM (technical memorandum) and FR (full report).

In addition to the 4 assignments for each lab, there will be a midterm practical and a final practical (both are closed book and performed individually).

Grading Scale

The grading is first recorded on CANVAS in percentage, and then converted to letter grade using the scale described. The full point is 100 which consists of the following components

Lecture part (70% total):

Homework	27 %
In-class Quizzes	5 %
Midterm exam	15 %
Final exam	23 %

Lab part (30% total):

Pre-lab	4.5 %
Lab-notes	4.5 %
Lab-report	9 %
Lab-quiz	3 %
Midterm practical	4.5 %
Final practical	4.5 %

The following grading scale (P) is applied to determine your letter grade for the course:

90 ≤ P	:	A
80 ≤ P < 90%	:	B
70 ≤ P < 80%	:	C
60 ≤ P < 70%	:	D
P < 60%	:	E

Midterm Grades

For undergraduates, midterm grades will be posted in myUK by the deadline published in the [Academic Calendar](https://registrar.uky.edu/academic-calendars/university). (<https://registrar.uky.edu/academic-calendars/university>). The grade will be calculated based on the completed course work by the midterm exam day.

Attendance Policy/Acceptable Documentation

Attendance of lecture and lab classes are required unless you have acceptable excuses. See <https://provost.uky.edu/proposals/guidance-course-proposals/standard-academic-policy-statements> for university guidelines on types of excuses. As part of enforcing the attendance requirements, signatures are collected and quizzes are given on some unnoticed meeting dates. The course instructor will follow university's general policy to decide if an absence is excusable (you may be asked to provide certain documentation or notes as evidence of excuses). For any missed course work due to accepted excuses, the student is responsible for contacting the instructor or TA to schedule makeup work.

Assignment Policies

Assignment Submissions

- (a) Unless explicitly stated, all assignments will be submitted on CANVAS under the corresponding assignment item on or before the due date/time. For in-class assignment submission, if you encounter difficulties submitting your work to CANVAS, you shall submit a hard copy to the instructor by the deadline and then submit the same copy to CANVAS within one day of deadline to be considered as on-time submission. This applies to all in-class work only.
- (b) Midterm exam, tests, and final exam (lecture part), midterm and final practical (lab) will be submitted in hard copy.

Returning Assignments to Students

Most work submitted on CANVAS will be graded electronically and you will be able to review the graded work. For midterm/final exam (lecture) and midterm/final practical (lab), the submissions are in hard copy and will not be returned. You will be provided with opportunities to review your graded work. Details will be announced in classes.

Late Assignments

Unless otherwise specified (such as the MH connect assignments), all late submissions will subject to grade reductions (except for acceptable excuses). The deduction policy will be given per assignment. If an assignment has no late submission policy specified, it means no later submission will be accepted for that assignment). The deadline for submission of any later work is 11:59pm on the day before the first Reading Day. No submissions will be accepted on or after the first Reading Day. The base of deduction (for acceptable late submission) is your earned points for any submission.

Assignments Due during Prep Week

Some regular assignments (on weekly basis) may have due dates on the prep week (but not on the Reading Days).

There will be no required interactions, e.g. meetings, activities, assignments, on the Reading Days. However, make-up work (for those who have excused absences) may be scheduled on any date before the final exam date (upon the request of the student).

Academic Policy Statements

A full list of UK academic policies is available at

<https://provost.uky.edu/proposals/guidance-course-proposals/standard-academic-policy-statements>.

Academic Offenses (Cheating, Plagiarism, and Falsification or Misuse of Academic Records)

UK policies on academic offenses are available at

<https://provost.uky.edu/proposals/guidance-course-proposals/academic-offenses>

Resources

The University of Kentucky and the Pigman College of Engineering offer a wide range of student support services. Below are links to a few good starting points for finding the support you may need for success in your studies:

- Center for Support and Intervention: <https://studentsuccess.uky.edu/center-support-and-intervention/resources/student-resources>
- UK Student Success services page: <https://studentsuccess.uky.edu/find-services>
- James and Gay Hardymon Center for Student Success
<https://www.engr.uky.edu/students/student-success>
- Disability Resource Center: <https://studentsuccess.uky.edu/disability-resource-center>
- Tutoring and Coaching: <https://studentsuccess.uky.edu/academicresources> and
<https://www.engr.uky.edu/students/student-success/engineering-tutoring>

Commented [JMT1]: This is no longer a requirement as a separate component. Recommendation is to leave it as a part of the Resources section.

[Optional] Diversity, Equity, and Inclusion

<https://www.engr.uky.edu/diversity-and-inclusivity>

In the Pigman College of Engineering, we embrace diversity and recognize our responsibility to create a welcoming environment where students, faculty and staff of all backgrounds can come together to learn and work. We value the benefits of a diverse campus and are committed to equity, inclusion and accountability. We believe diversity helps enrich and grow our college and are committed to engaging in an ongoing conversation to thoughtfully respond to the challenges and reality of our interconnected world.

Classroom Behavior Policies

Please refer to UK student conduct policies at <https://studentsuccess.uky.edu/student-conduct>]

Course Recordings

The University of Kentucky Code of Student Conduct defines Invasion of Privacy as using electronic or other devices to make a photographic, audio, or video record of any person without their prior knowledge or consent when such a recording is likely to cause injury or distress.

Meetings of this course may be recorded. All video and audio recordings of lecturers and class meetings, provided by the instructors, are for educational use by students in this class only. They are available only through Canvas shell for this course and are not to be copied, shared, or redistributed.

As addressed in the Code of Student Conduct, students are expected to follow appropriate university policies and maintain the security of linkblue accounts used to access recorded class materials. Recordings may not be reproduced, shared with those not enrolled in the class, or uploaded to other online environments.

If the instructor or a University of Kentucky office plans any other uses for the recordings, beyond this class, students identifiable in the recordings will be notified to request consent prior to such use. In anticipation of such cases, students may be asked to complete an “authorization of use” form by a faculty member.

Video and audio recordings by students are not permitted during the class unless the student has received prior permission from the instructor. Any sharing, distribution, and or uploading of these recordings outside of the parameters of the class is prohibited.

Students with specific recording accommodations approved by the Disability Resource Center should present their official documentation to the instructor.

Course Copyright

All original instructor-provided content for this course, which may include handouts, assignments, and lectures, is the intellectual property of the instructor(s). Students enrolled in the course this academic term may use the original instructor-provided content for their learning and completion of course requirements this term, but such content must not be reproduced or sold. Students enrolled in the course this academic term are hereby granted permission to use original instructor-provided content for reasonable educational and professional purposes extending beyond this course and term, such as studying for a comprehensive or qualifying examination in a degree program, preparing for a professional or certification examination, or to assist in fulfilling responsibilities at a job or internship; other uses of original instructor-provided content require written permission from the instructor(s) in advance.

Policy on Artificial Intelligence

The policy will follow the recommendations from the UK ADVANCE committee that are available at: https://advance.uky.edu/sites/default/files/2023-12/to%20post_UK-ADVANCE-instructional-guidelines-14Dec2023.pdf

<MORE: Appendix starts on next page>

Appendix: Classroom Emergency Preparedness and Response

Nothing is more important than the safety and well-being of our campus community. While the University of Kentucky Police Department continues to enhance campus safety measures, it's important to remember that everyone has a responsibility in keeping our community safe. To find more information visit [Emergency Response Guide | University of Kentucky Police Department \(uky.edu\)](https://police.uky.edu/emergency-response-guide)

Emergency Reporting & Action

Reporting

If there is an emergency, **DIAL 911**. To report suspicious activity or non-emergency situations, call the UK Police Department at 859-257-8573 or #UKPD from any mobile phone.

If an emergency occurs in a classroom or residence hall with a red emergency button, press to quickly notify UKPD. Emergency responders will immediately be dispatched to your location.

Action

During an emergency, you are responsible for your own safety.

If an emergency occurs during class, your instructor will provide further direction based on university and department emergency plans.

Warning Systems

UK Alert

The university provides emergency notifications through UK Alert, which sends messages via email, text message, phone calls, building alarm systems, digital signage, social media and outdoor sirens. If you receive a UK Alert message during class, notify your instructor and classmates immediately.

For more information, visit <https://police.uky.edu/get-notified/uk-alert>.

LiveSafe

The university provides additional emergency preparedness information and safety tools through LiveSafe, a free mobile app for iOS and Android. You can report suspicious activity, message with UK Police and virtually escort your friends through the SafeWalk tool.

For more information, visit <https://police.uky.edu/safety/livesafe>.

Blue Emergency Towers

Blue Emergency Notification Towers are strategically placed at over 50 locations across campus to provide outdoor alert tones and broadcast emergency messages with loud speakers. Each tower also features an emergency push button speaker phone that reaches UKPD and a camera mounted above the tower.

For more information, visit <https://police.uky.edu/safety/blue-emergency-towers>.

Medical Emergency

If there is a medical emergency, dial 911 and do not act outside the scope of your medical training. After dialing 911, inform your instructor of the situation.

Appendix: Classroom Emergency Preparedness and Response

Evacuation

It is required to evacuate for a fire alarm or when university officials order us to do so. Evacuation routes are marked with illuminated exit signs throughout the building. Avoid using elevators during any evacuation.

Emergency Sheltering

Storm Sheltering

Report to the recommended shelter locations. Recommended shelter locations are marked throughout the building.

If shelter locations are unavailable, protect yourself from lightning and flying debris by moving to an interior room or hallway on the building's lowest level. Avoid outside doors and windows and get under a sturdy table and use your arms to protect your head and neck.

Shelter-in-Place

If a shelter-in-place order is issued, you will learn about this through UK Alert, the university's emergency notification system.

If you are inside, stay where you are unless the building you are in is affected. If the building is affected, and the fire alarm has been activated or directed by law enforcement, you should evacuate. If you are outdoors, proceed into the closest UK building or follow instructions from emergency personnel or alerts.

It is ideal to shelter-in-place in an interior room with the fewest or no windows and no doors to the outside if possible. Shut all windows and close exterior doors.

If a hazardous chemical release occurs outside the building, follow these same procedures.

Active Aggressor

In a situation where an aggressor is trying to attack you or others, follow three steps:

1. Run - Attempt to get away from the attacker.

2. Hide - If you cannot run, barricade yourself in a safe place. Turn your phone to silent and dim your brightness. If possible, use the LiveSafe App to message UK Police and alert them to your location. If you don't have the app, dial 911. If you cannot speak, leave the line open and allow the dispatcher to listen.

3. Fight - If you cannot run or hide, do whatever you need to do to stop the attacker.

UK Police will communicate additional information through the UK Alert system during an active aggressor situation. Every UKY email automatically receives UK Alerts. You can also sign up in myUK to receive alerts via text and phone call.