ECE 461: Power Systems

Syllabus

Fall Semester, 2025

1 Basic Course Information

1.1 Contact Information

Professor: Dr. James Cale — Email: jcale@colostate.edu
TA: Seun Ojomu — Email: Seunfunmi.Ojomu@colostate.edu

1.2 Course Description

This undergraduate course is an introduction to the analysis of electrical power systems in terms of current, voltage, active/reactive power and power quality. It includes single- and three-phase power analysis, building-up to the general power flow problem on a transmission system. It also includes the analysis and feedback control of electrical motors using a power-electronic drive. This course also includes laboratories to reinforce course content and enhance students' understanding of power systems. 4 credit hours.

1.3 Meeting Location and Time (Lecture)

Anatomy-Zoology E112, CSU Fort Collins campus, Tuesday and Thursday, 12:30–1:45 PM (MST). Classes will also be streamed via Echo.

1.4 Meeting Location and Time (Laboratory)

Engineering Building C207, CSU Fort Collins campus. Time periods for the laboratories will be established in the first few weeks of class. See Laboratory syllabus for details.

1.5 Prerequisites

– ECE 332 (with a grade of C or higher)
– Working knowledge of MATLAB is required for this class

1.6 Course Materials

All materials for this course will be provided. The lecture component includes typed notes ("monograph") and slides. The laboratory includes descriptions that will be posted online (see separate Laboratory syllabus). *No textbooks are required for this course.*

1.7 Office Hours

The instructor will hold regular office hours on T/Th, 10:30–11:30 (MST). By default, office hours will be held via Zoom. If you would like to meet in-person, please arrange with the instructor at least one day in advance. Office hours may also be requested with the TA; contact the TA directly to schedule online on in-person office hours.

2 Course Assignments & Grading Weights

2.1 Homework

These will consist of shorter analytical and/or simulation problems in MATLAB (software is on ETS website). The homework problems are to be solved *individually*. Homework will generally be due in approximately 1.5 weeks, e.g., released on a Tuesday and due on Thursday of the following week. No late homework will be accepted; however, **one homework score will be dropped**.

2.2 Exams

There will be three in-class examinations in this class; the final exam will be comprehensive. Exam problems will be based on the material discussed in lecture, homework, and laboratories. No make-up exams will be given, except possibly under severe extenuating circumstances. If unable to make a deadline or comply with a time constraint for any reason, contact the instructor at least five days beforehand.

2.3 Exam Dates, Times & Locations

Exam 1: Sept. 30th, 12:30–1:45 PM, Anatomy-Zoology Room E112
Exam 2: Nov. 4th, 12:30–1:45 PM, Anatomy-Zoology Room E112
Final Exam: Dec. 9th, TBD*

*I'll attempt to schedule the final exam in the same room as the lecture; exact room and time will be announced several weeks prior to the final exam.

2.4 Laboratory Assignments

There will be a total of five (5) laboratories for this class, with four (4) assignments ("lab reports") that are due, see additional detail in the Laboratory syllabus.

2.5 Make-up Assignments

No make-up homeworks or exams will be given, except possibly under severe extenuating circumstances. If unable to make a deadline or comply with a time constraint for any reason, contact the instructor at least five days beforehand. However, you may schedule alternative or "extra" lab time if needed; contact the TA directly to arrange.

2.6 Keeping Up With Material

Content in this course is *cumulative* and it's important to attend lectures and complete all homework assignments. If you do not attend a lecture, or need to review prerequisite technical concepts or basic coding in MATLAB, you are responsible for reviewing the material on your own time.

2.7 Course Grading Weights

Homework:	25%
Lab Reports:	25%
Exam 1:	15%
Exam 2:	15%
Final Exam:	20%
Class Participation*:	3%

*Bonus credit (up to 3%) is given for active class participation. Examples include: contributing to the live class discussion, answering questions posed in lecture, etc.

3 Tentative Course Schedule By Week

Week	Dates	Topic
1	8/26, 8/28	Course introduction, notation; review of phasor analysis, energy and power balance
2	9/2, 9/4	Complex power flow analysis; power factor correction
3	9/9, 9/11	Measures of distortion, power quality; magnetic equivalent circuits
4	9/16, 9/18	Single-phase transformers; brushed DC machine model
5	9/23, 9/25	Open-loop DC machine response; intro to DC/AC "H-bridge" converters
6	**9/30**, 10/2	Exam 1; exam review, phase margin stability
7	10/7, 10/9	Feedback control of DC machine; intro to DC/DC converters
8	10/14*, 10/16*	Laboratory or at-home assignments only (no in-person classes)
9	10/21, 10/23	DC/DC converter analysis; three-phase power, Delta-Y transforms
10	10/28*, 10/30	Line impedance, transmission line models
11	**11/4**, 11/6	Exam 2; exam review, synchronous generator model
12	11/11, 11/13	Per-unit system, nodal admittance matrices; Newton-Raphson
13	11/18, 11/20	Jacobians and system constraints; the power flow problem
14	11/25, 11/27	Fall recess (no in-person class session)
15	12/2, 12/4	Numerical solution of the power flow problem; Guest Lecture
16	**12/9**, 12/11	Final exam week (no in-class session)

Dates in **bold** are exam dates. *Instructor on travel (e.g., technical conference).

Table 1: Tentative Topics by Week.

4 Course Policies

4.1 AI Usage Policy

Artificial intelligence (AI) tools may be used for this course, e.g., to process and format data, generate portions of code, etc. Using AI as a tutor to help deepen your understanding of the material is encouraged. You are however cautioned that your real intelligence (RI) must understand the content; you will not have access to AI during exams. You can use generative AI (e.g., ChatGPT, Dall-E) and other tools for these purposes, however, **you must cite and describe your AI use in your submitted work**. You may *not* submit material generated by AI that is misrepresented as your own, self-generated creative work.

Example AI-usage citation (MATLAB): Include at top of file: `% I used AI to [fill in]`

Permitted With Citation:

– Use of AI for data processing, analysis and to summarize results

– Use of AI to assist with coding or writing sections of code

– Use of AI to assist with formatting, grammar and readability of submitted work

Important: Anything you submit that was generated by AI has your explicit "check-off" and approval; any mistakes or errors are yours—you will *not* be able to claim that "it was AI's mistake."

4.2 Communication Policy

Questions on the course material can usually be answered most quickly via Canvas messaging or email; this is the preferred method when possible. The TA and/or instructor will respond to your inquiry within 36 hours (typically sooner). For more in-depth questions, use office hours.

4.3 Grading Policy

Grades on homework, laboratories and exams will generally be posted in Canvas by one week after the due date. In addition, solutions to assignments will typically be posted within a day of the due date so you'll have a good idea of your grade before it's posted. If there is an unexpected delay in grading, the updated date will be announced to the class.

4.4 Regrades

Regrading can only be accommodated under two circumstances: (1) incorrect calculation of scores or (2) incorrect assignment of scores. **All requests for regrading must be turned in within 5 days of the return of the graded homework/exam**. If requesting a regrade, email the TA with an explanation of your regrade request. Note that your solution to the entire problem as well as the regrade request will be scrutinized; final allocation of credit is at the discretion of the TA.

4.5 Final Grade Assignments

Grade	Score
A+	96.67–100.00
A	93.33–96.66
A-	90.00–93.32
B+	86.67–89.99
B	83.33–86.66
B-	80.00–83.32
C+	76.67–79.99
C	70.00–76.66
D	60.00–69.99
F	0.00–59.99

4.6 Sexual Harassment-Free Environment

Colorado State University strives to create and maintain a work and study environment that is fair, humane, and responsible so that each member of the University community is treated with dignity and rewarded for such relevant considerations as ability and performance. Abusive treatment of individuals on a personal or stereotyped basis is contrary to the concepts of academic freedom and equal opportunity. Sexual harassment is one form of such abuse and cannot be tolerated.

4.7 Academic Integrity

The faculty expects every member of the CSU community to practice honorable and ethical behavior in the classroom. Any actions that might unfairly improve a student's score on homeworks, laboratories or examinations will be considered academic misconduct and will not be tolerated. Examples of academic misconduct include (but are not limited to):

– Sharing results or other information during homeworks or examination.

– Working on an exam before or after the official time allowed.

– Requesting a regrade of answers or work that has been altered.

– Submitting assignments that are not your own work or engaging in forbidden collaborations.

– Representing as your own work anything that is the result of the work of someone or some thing else. This includes use of AI (without citation), solutions obtained via solution manuals, the Internet and/or other services.

At the professor's discretion, academic misconduct on an assignment or examination/report will result in a reduced score, a zero score, or a failing grade for the course. All occurrences of academic misconduct will be reported to the Vice President for Student Affairs and copied to the ECE Department Head. If there is any question as to whether a given action might be construed as academic misconduct, please see the professor before you engage in any such action. For more information, please see CSU's page on Practicing Academic Integrity.

4.8 Additional Resources and Policies

For additional information on university resources and policies, see the "Resources and Policies" document posted under Canvas > Modules > Organizational.

ECE 461: Power Systems Laboratory

Laboratory Syllabus

Fall Semester, 2025

1 Basic Laboratory Information

1.1 TA's Contact Information

Teaching Assistant: Seun Ojomu Email: Seunfunmi.Ojomu@colostate.edu

1.2 Description

These laboratories are designed to reinforce course content and enhance students' understanding of electrical motors and their control using power-electronic drives.

1.3 Location

Engineering Building C207, Colorado State University, Fort Collins campus.

1.4 Laboratory Dates & Times

The TA will post open time slots in Canvas the first week of class. Let the TA know via email or Canvas which time your group would like to perform experiments on laboratory weeks. Finalized laboratory dates/times for each group will then be posted on Canvas.

1.5 Laboratory Groups

The TA will divide the class into lab groups of approximately four (4) students each at the beginning of the semester. The groups will be posted in Canvas under People > Groups. If a group of students would like to form their own group, let the TA know as soon as possible; any changes must be made by **Sept. 4th** so laboratory meeting dates/times can be coordinated before the first laboratory week.

Your group will work together on all laboratory experiments and lab reports. Each group needs to designate a representative "leader" for the group. The group leader will be responsible for ensuring the lab reports are submitted on time, on behalf of the group.

2 Laboratories & Assignments

There will be a total of five (5) laboratories and four (4) assignments ("lab reports") that are due, see the schedule in Table 1. The laboratory descriptions and assignments are provided under "List of experiments" on the Sciamble page below, experiments 1-5. Lab reports need to be uploaded to Canvas by the group leader before the due date for full credit.

2.1 Laboratory Information (Sciamble) & Workbench Download

`https://sciamble.com/Resources/pe-drives-lab/basic-drives`

2.2 Assignment Points

Assignment 1 (Report for Labs 1&2): 25 pts
Assignment 2 (Report for Lab 3): 25 pts
Assignment 3 (Report for Lab 4): 25 pts
Assignment 4 (Report for Lab 5)): 25 pts

*Bonus credit (up to 3%) is given for active class participation. Examples include: contributing to the live class discussion, answering questions posed in lecture, etc.

3 Laboratory Descriptions and Execution Week

Lab	Week	Topic
1	4	Introduction: An introduction to the basic components of an electric drive system and general idea of the speed-control of a DC motor.
2	5	Switched-mode DC-DC converter: Modeling of a SMDC-DC electronic converter in Workbench simulation software.
3	8	Characterization of DC motor: Determining the parameters of a DC motor and modeling it in Workbench simulation software.
4	11	DC motor speed control.
5	15	Four-quadrant operation of DC motor.

Table 1: Laboratories by Week (schedule tentative).

4 Laboratory Policies

4.1 Make-up Laboratories

You're group is expected to perform the laboratory assignments on the agreed-upon time window. However—on a limited basis—if you need to schedule an alternative or "extra" lab time, contact the TA to arrange a time.

4.2 Communication Policy

Questions on the laboratory material can usually be answered most quickly via Canvas messaging or email; this is the preferred method when possible. The TA will respond to your inquiry within 36 hours (typically sooner). For more in-depth questions, schedule a meeting with the TA.

4.3 Grading Policy

Grades on laboratories will generally be posted in Canvas by one week after the due date. If there is an unexpected delay in grading, the updated date will be announced to the class.

4.4 Regrades, AI-Usage & Other Policies

Refer to the Course Syllabus.