ECE/ENGR 565: Electrical Power Engineering

Syllabus
Fall Semester, 2023

Professor:	Dr. James Cale	Email:	jcale@colostate.edu
TA:	Seunfunmi Ojomu	Email:	seunfunmi.ojomu@colostate.edu
Office Hours:	W 4:00–5:00 PM via Zoom	Phone:	(970) 412–0494

Meeting Location and Time

Clark Building, C217, CSU Fort Collins campus, Wednesday evenings, 5:15–8:00 PM (MST). Classes will also be recorded via Zoom.

Prerequisites[†]

- ECE 332, ECE 342, and familiarity with electric power systems, e.g., ECE 461/462 Power Systems-I/Laboratory
- Working knowledge of MATLAB/Simulink is required for this class.

Textbook

J.J. Grainger and W.D. Stevenson, *Power System Analysis*. McGraw-Hill. 1994. ISBN: 0-07-061293-5.

Other Learning Materials

Additional technical content for this course will provided via the instructor's lecture notes, displayed and/or written during lecture.

Software

MATLAB/Simulink install info: `https://www.engr.colostate.edu/ets/matlab/`

Course Description: Analysis of electrical power systems in terms of current, voltage, and active/reactive power. Analysis of symmetrical components, symmetric and unsymmetrical grid faults. Numerical solution of the power-flow problem and state-estimation. Introduction to computer-aided tools for the analysis of power systems.

Course Objectives: This graduate-level course is designed to provide a review of theory and computational tools used in electric power engineering for the purpose of understanding and computing power flows and fault conditions on the electric grid. The emphasis of the course is on topics related to power flow algorithms, fault studies, system stability and state observation. A popular software package will be used in class and several course assignments. 3 credits.

[†]Contact the instructor (jcale@colostate.edu) with questions and/or requests for waivers for the prerequisites.

Communication Policy

Questions on the course material can usually be answered most quickly via Canvas messaging or email; this is the preferred method where possible. Either I or the TA will respond to your inquiry within 36 hours (but typically sooner). For more in-depth questions, office hours on W 4:00-5:00 PM are also available to meet via Zoom. A Zoom link for open office hours will be posted in Canvas under Announcements.

Course Grading Weights

Homework:	30%
Mid-term exam:	30%
Simulation Projects:	40%

Homework

Homework sets will consist of shorter analytical or numerical simulation problems. All homework will be graded and will generally be due two weeks after distribution (solution format, due dates/times will be listed on the assignment). No late homework will be accepted.

Mid-term Exam

There will be a "take-home" mid-term examination in this course, which will require hand-written and/or computer simulation solutions. The exam will be posted on Canvas at 5:00 PM (MST), Oct. 11, 2023. Solutions will be due via Canvas upload by 11:59 PM (MST), Oct. 12, 2023. No late solutions will be accepted.

Simulation Projects

This course includes two simulation projects, performing power systems analyses in MATLAB/Simulink (Simscape Electrical library). The purpose of these projects is to give students experience applying the numerical analysis techniques introduced in class to larger power system studies, visualization and interpretation of the results. Projects will generally be due 2-3 weeks after distribution (solution format, due dates/times will be listed on the project assignment). No late projects will be accepted.

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

Topics by Week:[†]

Week	Dates	Topic
1	8/23	Course introduction, basic power concepts (part 1): notation, time vs. phasor domain solutions, three-phase power
2	8/30	Basic power concepts (part 2): per-unit method, node equations, admittance and reactance diagrams
3	9/6	Transformers
4	9/13	Synchronous machines
5	9/20	Inductance and capacitance of transmission lines and bundled conductors
6	9/27	Transmission line models
7	10/4	Admittance and impedance models, network calculations (part 1)
8	10/11	Mid-term exam week (no in-person class session)
9	10/18	Admittance and impedance models, network calculations (part 2)
10	10/25	Guest Lecture
11	11/1	Power-flow problem and its solution
12	11/8	Symmetrical Faults, Power-flow in Simulink
13	11/15	Symmetrical Components
14	11/22	Fall recess (no in-person class session)
15	11/29	Unsymmetrical faults
16	12/6	Final exam week (no in-class session)

Lecture Material and Text

Knowledge in this course in cumulative, and having a solid understanding of the "basics" (covered in the first few lectures) is critical. Read the text book along with attending the lectures and complete all homework assignments. If you do not attend a lecture, or need to review prerequisite technical concepts or use of MATLAB/Simulink, you are responsible for reviewing the material on your own time.

Grading Policy

Grades on homework, projects and exams will generally be posted in Canvas one week after the due date. In addition, solutions to assignments will be posted within 24 hours 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.

[†]Session topics and dates may change based on added/deleted material and observed progress of students. In the event that the instructor is on business-related travel or personal (sick or emergency) leave the respective class will be pre-recorded *sans* audience and made available via the class URL on Canvas.

Exams and Projects

No make-up homeworks/exams/projects 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.

Regrades

Regrading can only be accommodated under two circumstances: (1) incorrect calculation of scores; (2) incorrect assignment of scores. **All requests for regrading must be turned in within 5 days of the return of the graded homework/project/exam**. When requesting a regrade, contact the course instructor. Note that your solution to the entire problem as well as the regrade request form will be scrutinized and the allocation of partial credit is at the discretion of the grader. In some cases, regrade requests may result in a reduced score.

Working Together

Studying together in this class is encouraged. However, any individual assignment (homework, projects, exams) *must be solely your own work*. Code and reports *will* be checked for plagiarism and plagiarism will not be tolerated. Academic misconduct has serious consequences (see below).

Classroom Etiquette

The golden rule applies. The online chat feature is for asking questions relevant to the course (only). Anyone misusing the chat feature (e.g., making inappropriate comments) will be barred from using chat and possibly removed from the course.

Academic Integrity

The faculty expects every member of the CSU community to practice honorable and ethical behavior both inside and outside the classroom. Any actions that might unfairly improve a student's score on homework, quizzes, or examinations/projects 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 homework, project or examination.
- Bringing forbidden material or devices to an (in-person) examination.
- Working on an exam before or after the official time allowed.
- Requesting a regrade of answers or work that has been altered.
- Submitting homework that is not your own work or engaging in forbidden homework collaborations.
- Representing as your own work anything that is the result of the work of someone or something (AI) else. This includes 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.* For information on the Honor Pledge, see the Honor Pledge.†

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. For more information, please see the CSU Office of Equal Opportunity's Sexual Harassment Policy‡ and Principles of Community§.

COVID-19 University Policy

We will follow any COVID-19 policies directed by the university. For the latest information about the University's COVID resources and information, please visit the CSU COVID-19 site: https://covid.colostate.edu/.

Additional Resources and Policies

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

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*http://learning.colostate.edu/integrity/
†http://tilt.colostate.edu/integrity/honorpledge/
‡http://oeo.colostate.edu/sexual-harassment-policy
§http://oeo.colostate.edu/colorado-state-university-principles-of-community/