College of Engineering
Department of Electrical and Computer Engineering
Fall 2025

EE555

Advanced Energy Distribution Systems

Tuesday and Thursday 2:10 pm-3:25 pm
Coover Hall 1011

Instructor: Dr. Zhaoyu Wang
Office: 1113 Coover Hall
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Office Hours: Tuesday 3:30-4:30 pm or by email appointment

Required Texts:

Electric Power and Energy Distribution Systems – Models, Methods, and Applications, S. S. Venkata & A. Pahwa, IEEE PRESS & WILEY, 2022. https://ieeexplore.ieee.org/book/10922800

Highly Recommended Texts:

Distribution System Modeling and Analysis, 4th edition, William H. Kersting, CRC Press, 2017.

Course Objectives

Students are expected to

- Understand differences between distribution and transmission systems
- Know major components of distribution systems
- Understand distribution system planning principals, designs, and economics
- Understand distribution system automation and operation, such as outage management, voltage control, reconfiguration, and restoration
- Model distribution system overhead lines, underground cables, three-phase transformers, single-phase transformers, voltage regulators, capacitor banks, loads, and DERs
- Develop codes to perform a three-phase power flow for a radial distribution system
- Perform distribution system fault calculations and understand distribution system protection
- Calculate distribution system reliability indices
- Use OpenDSS to perform distribution system modeling and analysis

General Information:

Questions concerning a grade given for any assignment must be presented to the instructor within 5 days after the grade is received. No exceptions to this rule will be permitted at any time, for any reason.

Deadlines are firm and will NOT be extended. If, for some extremely important, verifiable reason, you cannot

take any of the midterm exams at the scheduled time, the instructor must be notified prior to exam time, so proper arrangements can be made to administer the exam at another time. No excuses after the date of the exam will be considered. No makeup exams will be given at any time, for any reason. Exam dates may deviate from the schedule. It is your responsibility to know exam dates.

All information given in this document may be subject to change at some future date without notice.

Class Prerequisite: EE455. Familiarity with the following topics is essential: AC circuit analysis, three-phase circuit analysis, matrix algebra, calculus.

Class Preparation:
Reading and studying the scheduled material in the text in advance of the class will be essential. A tentative schedule of topics is given in this syllabus.

Grade Distribution:

60% Homework
40% Class project

Letter grades will be determined by the following guidelines:

90 and above	A
80 to 90$^-$	A- / B+ / B
70 to 80$^-$	B- / C+ / C
60 to 70$^-$	C- / D+ / D
60$^-$ and below	D- / F

Tentative Course Schedule:

Week	Class Dates	Class Topic	Book Chapter
1	August 26	Introduction to Distribution Systems	Chapter 1
	August 28	Introduction to Distribution System Transformers (three-phase & single-phase)	Chapter 2
2	September 2	Introduction to Distribution System Transformers (three-phase & single-phase)	Chapter 2
	September 4	Distribution Line Models	Chapter 3
3	September 9	Distribution Line Models	Chapter 3
	September 11	Voltage Regulation & Voltage Regulator Models	Chapter 4
4	September 16	Voltage Regulation & Voltage Regulator Models	Chapter 4
	September 18	Load and DER Models	Chapter 4
5	September 23	Power Flow Analysis	Chapter 4
	September 25	Power Flow Analysis	Chapter 4

6	September 30	Distribution System Fault Calculations	Chapter 4
	October 2	Distribution System Fault Calculations	Chapter 4
7	October 7	Distribution System Planning (Load Characteristics & System Design)	Chapter 5
	October 9	Distribution System Planning (Load Characteristics & System Design)	Chapter 5
8	October 14	Distribution System Economics	Chapter 6
	October 16	Introduction to Distribution System Operation and Automation (Outage Management, Reconfiguration & VVC)	Chapter 7
9	October 21	Introduction to Distribution System Operation and Automation (Outage Management, Reconfiguration & VVC)	Chapter 7
	October 23	Analysis of Distribution System Operation Functions (Outage Management, Restoration, Reconfiguration & VVC)	Chapter 8
10	October 28	Analysis of Distribution System Operation Functions (Outage Management, Restoration, Reconfiguration & VVC)	Chapter 8
	October 30	Distribution System Reliability	Chapter 9
11	November 4	Distribution System Reliability	Chapter 9
	November 6	Distribution System Grounding	Chapter 10
12	November 11	Distribution System Protection	Chapter 11
	November 13	Distribution System Protection	Chapter 11
13	November 18	OpenDSS Tutorial	
	November 20	OpenDSS Tutorial	
14	November 25	Thanksgiving Break	
	November 27	Thanksgiving Break	
15	December 2	Distribution System Power Quality	Chapter 12
	December 4	Distribution System Power Quality	Chapter12
16	December 9	DERs and Microgrids	Chapter 13
	December 11	Review and examples	
Final	December 15-18	Final exams	

Homework:

Homework will be collected at the beginning of class, on the due date announced in class.

Communication:

Feel free to communicate with the instructor in any way that is convenient to you (after class, during office hours, phone, e-mail), for questions about the course material or assignments. E-mail is an especially good way, but response time here is variable, typically ranging from a minute to about 24 hours, depending on the nature of your question and the instructor's schedule.

Free Expression:
Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

Academic Dishonesty:
The class will follow Iowa State University's policy on academic misconduct (5.1 in the Student Code of Conduct). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams, and for following directions given by faculty, instructors, and Testing Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the Office of Student Conduct in the Dean of Students Office. Information about academic integrity and the value of completing academic work honestly can be found in the Iowa State University Academic Integrity Tutorial.

Accessibility Statement:
Iowa State University is committed to advancing equity, access, and inclusion for students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of students with disabilities. Information about SAS is available online at www.sas.dso.iastate.edu, by email at accessibility@iastate.edu, or by phone at 515-294-7220.

Discrimination and Harassment:
Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu

Mental Health and Well-Being Resources:
Iowa State University is committed to proactively facilitating all students' well-being. Resources are available on the ISU Student Health and Wellness website (https://www.cyclonehealth.iastate.edu).

Religious Accommodation:
Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic

requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the Dean of Students Office at 515-294-1020 or the Office of Equal Opportunity at 515-294-7612.