College of Engineering
Department of Electrical and Computer Engineering
Fall 2023

EE555

Advanced Energy Distribution Systems

Tuesday and Thursday 9:30 am-10:45 am
Coover Hall 1012

Instructor: Dr. Zhaoyu Wang
Office: 1113 Coover Hall
E-mail: wzy@iastate.edu
Office Hours: Tuesday & Thursday 2:30-3:30 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.

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

Tentative Course Schedule:

Week	Class Dates	Class Topic	Book Chapter
1	August 22	Introduction to Distribution Systems	Chapter 1
	August 24	Distribution System Planning (Load Characteristics & System Design)	Chapter 5
2	August 29	Distribution System Planning (Load Characteristics & System Design)	Chapter 5

	August 31	Introduction to Distribution System Operation and Automation (Outage Management, Reconfiguration & VVC)	Chapter 7
3	September 5	Introduction to Distribution System Operation and Automation (Outage Management, Reconfiguration & VVC)	Chapter 7
	September 7	Analysis of Distribution System Operation Functions (Outage Management, Restoration, Reconfiguration & VVC)	Chapter 8
4	September 12	Analysis of Distribution System Operation Functions (Outage Management, Restoration, Reconfiguration & VVC)	Chapter 8
	September 14	Distribution Line Models	Chapter 3
5	September 19	Distribution Line Models	Chapter 3
	September 21	Introduction to Distribution System Transformers (three-phase & single-phase)	Chapter 2
6	September 26	Three-Phase Transformer Models	Chapter 2
	September 28	Voltage Regulation & Voltage Regulator Models	
7	October 3	Load and DER Models	Chapter 4
	October 5	Power Flow Analysis (branch flow)	Chapter 4
8	October 10	Single-Phase Transformer Models	
	October 12	Power Flow Analysis (Y-bus)	
9	October 17	Power Flow Analysis (Y-bus)	
	October 19	Distribution System Fault Calculations	Chapter 4
10	October 24	Distribution System Fault Calculations	Chapter 4
	October 26	OpenDSS Tutorial	
11	October 31	OpenDSS Tutorial	
	November 2	Distribution System Protection	Chapter 11
12	November 7	Distribution System Protection	Chapter 11
	November 9	Distribution System Protection	Chapter 11
13	November 14	Distribution System Reliability	Chapter 9
	November 16	Distribution System Reliability	Chapter 9
14	November 21	Thanksgiving Break	
	November 23	Thanksgiving Break	
15	November 28	Distribution System Power Quality	Chapter 12
	November 30	Distribution System Economics	Chapter 6
16	December 5	DERs and Microgrids	Chapter 13

	December 7	Review and examples	
Final	December 11-15	Final exams	