

Department of Electronics
Carleton University

ELEC 5200- Advanced Topics in Integrated Circuits and Devices:
Electrical Distribution Systems

Instructor: Dr. Shichao Liu, Assistant Professor

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Calendar Style Description:

This course introduces the fundamentals and state-of-the-art technologies of electricity distribution systems, including distribution system basics, feeder topologies, load characteristics, machine learning based load predictions, distribution automation, communication systems for distribution systems, distribution system performance and operation, distribution system planning, distribution system control, and smart grid technologies.

Grading Scheme:

	%
Assignment (Machine Learning based Load Predictions, Due: Oct. 23)	20
Project (Distribution System Power Flow Analysis) Due: Nov. 30	30
Final Exam: Week of Dec. 7 or later, to be determined.	50
Total	100

Text:

[1] Electric Power Distribution, Automation, Protection and Control, James A Momoh, CRC Press, 2008.

ISBN: 9 78-0-8493-6835-6

Other references:

[2] Control and Automation of Electrical Power Distribution Systems, James Northcote-Green and Robert Wilson, CRC Press.

ISBN: 978-1-4200-1484-6 (eBook - PDF)

[3] Power Distribution Planning Reference Book, H. L. Willis, Marcel Dekker, Inc.

ISBN: 0-8247-4875-1 (Print Edition)

[4] T K Nagsarkar and M S Sukhija, Power system analysis, 2nd edition, Oxford Higher Education, 2014.

[5] J D Glover, M S Sarma, and T J Overbye, Power System Analysis and Design, 5th Edition, Cengage Learning, 2012

[6] ANTONIO GOMEZ-EXPOSITO, ANTONIO J. CONEJO, CLAUDIO CANIZARES, Electric Energy System: Analysis and Operation, CRC Press, 2009

Course Outline

Week-by-Week Description:

- Week 1-- Introductions on distribution feeder topologies, distribution primary system, distribution secondary systems, transformers.
- Week 2 and Week 3-- Load characteristics: definitions, metrics and load curves
- Week 4-- load predictions: Trending, support vector machine, neural networks, and fuzzy logics
- Week 5-- Distribution automation: components and architectures
(Lecture 9: OCT. 8th, Guest Lecture: Dr. Mostafa Farrokhbadi (Senior Director of Technology: BluWave-AI))
- Week 6-- Communication systems for distribution automations: requirements, wireless communication for distribution systems, wired communications for distributions, and existing examples.
- Week 7 and Week 9-- Distribution system performance and operation: harmonics, capacitor applications
- Week 10—Distribution system power flow analysis
- Week 11-- Distribution system voltage regulation: voltage drop, power loss, voltage regulator design
- Week 12: Energy management system and state estimation
- Week 13-- Microgrids.
- Week 14—Final Exam

CULearn:

CULearn will be used for communication and posting of course material, including lecture slides. The CULearn site can be accessed from <https://www.carleton.ca/culearn/>. Please refer to the CULearn site frequently in order to keep up-to-date with the course material that is posted there.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at <http://www.carleton.ca/equity/>