

Department of Electronics
Carleton University

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

Instructor: Dr. Shichao Liu, Assistant Professor

Office: Minto Centre 7042

Phone: 613-520-2600 ext. 5762

Email: shichaoliu@cunet.carleton.ca

Course Delivery Method: In-Person

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:

	%
Project 1: Machine Learning based Load Predictions and Presentation, Maximum: two students per group. Due: 11:59 PM, Oct. 23, 2022	30
Project 2 -Reviewing State-of-the-art technologies of distribution system operation, control, and planning, potential topics will be given and Presentation, Maximum: two students per group. Due: 11:59 PM, Nov. 28, 2022	20
Final Exam: Date to be determined. Closed-book, one cheat sheet (2 sides) is allowed.	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 (Starting September-8-2022)-- Introductions on power system structure, distribution feeder topologies, distribution primary system, distribution secondary systems, transformers.
- Week 2 -- Load characteristics: definitions, metrics and load curves
- Week 3-- load predictions: Trending approach, support vector regression, and neural networks, Non-Intrusive Load Monitoring (NILM)
- Week 4-- Distribution automation: components and architectures
- Week 5-- Communication systems for distribution automations: requirements, wireless communication for distribution systems, wired communications for distributions, and existing examples.
- Week 6 and Week 7-- Distribution system performance and operation: power system calculation basics, voltage drop, capacitor applications, voltage regulations
- **Week 8 (Week of Oct-24-2022): Fall Break**

- Week 9—Distribution system power flow analysis
- Week 10: Presentations of Project 1 (each group: max 2 students, in total 10 mins)
- Week 11— Distribution Power flow Analysis
- Week 12--- Microgrids (1.5 lectures) +course review (0.5 lecture).
- Week 13-- Presentations of Project 2 (each student: 8 mins, two-student group-16 mins)
- Week 14 -- Presentations of Project 2 (each student: 8 mins, two-student group-16 mins)
- Final Exam (TBD by Exam Center)

BrightSpace:

BrightSpace will be used for communication and posting of course material, including lecture slides. **The instructor owns course material copyright. Students should not re-post the materials on any websites without the agreement of the instructor**, such as Course Hero and others.

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/>

Covid Recommendations:

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are a number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

Masks: Carleton has paused the COVID-19 Mask Policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

Vaccines: Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the University's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.