

Carleton University
Department of Electronics
SREE 3002 Electrical Distribution Systems
Course Outline
Winter 2024

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Office Hours: By appointment Online or In-person

TA: TBA

Course Objectives:

This course introduces the fundamentals of the electricity distribution system, including distribution topology, load characteristics, load prediction, voltage regulation, power flow, power loss, power qualities, state estimation, system reliability, system protection. Distribution Automation: components and architectures, communication systems. Distributed Generation: guides and regulations, integrations, microgrid. By the end of the course, students should be able to:

1. Understand load characteristics and design load prediction algorithms,
2. Participate in the design and operation of the electricity distribution system,
3. Understand the distribution automation and the SCADA system,
4. Properly choose communication systems for distribution automations,
5. Understand the problems and solutions associated with the integration of distribution generations into the distribution systems.

Prerequisites: SREE 3001 and (ELEC 2602 or ELEC 3605).

Textbook:

No Official Textbook.

References:

[1] Electric Power Generation, Transmission, and Distribution, Leonard L. Grigsby, (3rd ed.). CRC Press. *(Online version is available in Carleton Library Database).*

[2] Electric Power Distribution System Engineering, Turan Gonen, Third Edition, CRC Press, *(Online version is available in Carleton Library Database).*

[3] Electric Power Distribution, Automation, Protection and Control, James A momoh, CRC Press.

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

[5] Spatial Electric Load Forecasting, H. L. Willis, Marcel Dekker, Inc.

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

[7] Electrical Motors and Drives: Fundamentals, Types and Applications, Third Edition. Austin Hughes, Elsevier and Newnes.

[8] Electrical Machine Drives: Fundamental Basics and Practice, Claition Moro Franchi, CRC Press.

Evaluation Procedures:

1. Final exam50%
2. Project-Load Forecasting20%
3. Midterm20%
4. Lab reports10%

A grade of at least 50% on the final exam is required to be eligible to pass the course. Students must complete all labs to be eligible to pass; otherwise, a grade of **F** will be assigned.

Lab and PA Schedule:

Lab and PA sessions are 1 hours in duration. Individual Labs and PA will be held according to the schedule, which will be posted on Brightspace. You must attend the Lab and PA session you are registered in. You must complete all Labs. Retain records of your graded lab reports until the end of the term in case they are needed to confirm your grades.

The intention is to have the labs in-person at Carleton University. There will be 2 labs scheduled over the term. Each student is required to independently complete and submit all laboratory reports. Submitted reports should be high-quality documents. Lab reports should convey all data, calculations, graphs etc. and contain the necessary conclusions and discussions. All submitted reports must be in PDF file format. A PDF of a handwritten lab report is not acceptable. Students have the choice of software and materials to prepare their reports, but reports must be neat, legible, and coherent. The objective of the labs is to gain hands-on experience making measurements, recording and plotting data, not to write lengthy reports. Labs will be graded partly on the ability to demonstrate your experimental work to the TA, and partly on lab reports. Discretionary deductions may be applied to illegible and sloppy reports.

Lab reports are to be submitted within **48 hours from the end of the lab period**. In order to pass SREE3002, it is necessary to complete the lab. If you miss a lab due to illness or other valid reason you must arrange a time to complete a make-up lab. The TAs will be available in the lab and during the scheduled lab period. If you require assistance, go to the scheduled lab period and location. No laboratory exemptions are given to students who are repeating the course. Laboratory is worth 10% of your final grade. All laboratory pages are to be printed by the student from Brightspace.

There is a penalty of **20%** per day for late lab reports.

Course materials, such as references, notes, etc., are permitted during lab sessions. Please note, it is strongly recommended that you review the assigned material **BEFORE** coming to the lab. Please come prepared!

Project-Load Forecasting and PA Sessions:

You are allowed and encouraged to work with other classmates on the project sets, this is for the benefit of understanding the material. **A PA session will be held by the TA in the lab room to clarify the Load Prediction project and related Software.** You must attend the PA section. If you miss a PA session, it is up to you to obtain answers to the assigned project.

Mid-term:

There will be 1 mid-term during the term. **The mid-term will be held during the regular class time.** The mid-term will account for 20% of your final grade. Please make sure you attend the mid-term during the scheduled time. Mid-term will be a **Closed Book**. If you miss the mid-term with a valid reason, a makeup mid-term will be made available. Sorry, no makeup of a makeup mid-term. A grade of zero is assigned to a student who misses the makeup mid-term. Under no circumstances will the grade weight of the mid-term be transferred to the final exam.

Final Exam:

The format of the final exam is a **take-home Exam**. The final take-home exam will be available online on the last day of class. It is due at the end of the day on April 25, 2024.

More information will be provided later in the term.

Lecture Topics:

The list below indicates possible topics and tentative schedules covered in the course.

- Week 1- Introductions on distribution feeder topologies, distribution primary system, distribution secondary systems, transformers.
- Week 2- Load characteristics: definitions, metrics and load curves
- Week 3- Load characteristics: Motors
- Week 4- load predictions: Trending and neural networks
- Week 5- Distribution system performance and operation: voltage drops
- Week 6- Distribution system performance and operation: voltage regulation, capacitor applications
- **Week 7—Winter Break, no classes.**
- Week 8- Power Flow Analysis
- Week 9- Distribution automation: components and architectures, demand side response
- Week 10- Communication systems for distribution automations: requirements, wireless communication for distribution systems, wired communications for distributions, and existing examples.
- Week 11- Distribution system protection and substation grounding design.

- Week 12- Distribution system reliability
- Week 13- Microgrids with distributed generation integration (Plug-in hybrid electric vehicles (PHEVs) and electric vehicles (EVs))
- Week 14- Review

Course Delivery:

In Person

BrightSpace:

Brightspace will be used for communication and posting of course material, including lecture slides. Please refer to the **Brightspace** site frequently in order to keep up-to-date with the course material that is posted there.

Plagiarism Policy: When you use (for example, quote or even summarize or paraphrase) someone else's media, words, data, ideas, or other works, you must cite your source. You should be especially careful to avoid plagiarizing Internet sources (for example, e-mail, chat rooms, Web sites, or discussion groups). It does not matter whether you borrow material from print sources, the Internet, online databases, or interviews. Failure to cite your source is plagiarism. Students who plagiarize may receive an "F" or a "0" for the assignment or an "F" for the course. Plagiarism is a serious instructional offense that can not be tolerated. For additional information, please refer to the section on instructional offenses in the Undergraduate Calendar.

Use of Course Materials: Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy-protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

Attendance Policy: When you miss a class, it is your responsibility to obtain the missed information.

Student E-mail Policy: The University sends official communications to Carleton e-mail addresses. This address will receive notices about schedules, grade results, billing information, emergency alerts, important deadlines, newsletters, and all other official university information. It is your responsibility to read and manage this e-mail. Make sure you receive any correspondence in regard to this course. Please note the instructor of this course is not responsible for missed e-mail communication directed to your spam folder.

Examination Policy: The use of communication or recording/playback devices, with the exception of devices explicitly permitted by the course instructor, is prohibited during quizzes and examinations. This includes, but is not limited to, cell phones, PDAs, iPods and MP3 players, tablets, computers, cameras, and headphones or in-ear earphones. All such devices must be turned off and put away in an inaccessible location, such as a backpack. Accessing a prohibited device will result in the immediate termination of the quiz or examination and may result in a charge of academic misconduct.

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, visit the Equity Services website: http://carleton.ca/equity/accommodation/student_guide.htm

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, visit the Equity Services website: http://carleton.ca/equity/accommodation/student_guide.htm

Students with disabilities requiring academic accommodations: In this course, you must register with the Paul Menton Centre for Students with Disabilities (PMC) to formally evaluate disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC at 613-520-6608, every term to ensure that I receive your Letter of Accommodation no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam(s) in this course, please submit your request for accommodations to PMC by the last official day to withdraw from classes in each term. For more details, visit: http://www.carleton.ca/pmc/students/acad_accom.html