

SREE 3002: Electrical Distribution Systems

Introduction

In this course you will learn the fundamentals of the electricity distribution system, including distribution topology, load characteristics, distribution automation, communication systems for distribution systems, voltage regulation, power qualities, state estimation, reliability, and distribution generation integrations.

Course Description and Requirements

Course Description: Electricity Distribution: topology, load characteristics, load prediction, voltage regulation, power flow, power loss, capacitors, state estimation, system reliability, system protection. Distribution Automation: components and architectures, communication systems. Distributed Generation: guides and regulations, microgrids, case study.

Prerequisite(s): SREE 3001 and (ELEC 2501 or ELEC 3605)

Lectures: 3 hours per week.

Laboratory and problem analysis: 1 hour per week

Instructor

Professor: Shichao Liu

Email: shichaoliu@cunet.carleton.ca

Course Webpage: on Brightspace

Office Hour: 2:30PM-3:30 PM on Tuesdays

Textbook: Please include price of books

1) Electrical Power Distribution System Engineering, Turan Gonen, Third Edition, CRC Press, Main reference (Online version is available in Carleton Library Database), Printed version price: CAD 118.83.

Lecture Outline

In person, Tuesdays and Thursdays, 8:35 AM – 9:55 AM

The following topics will be covered during the course lectures with an approximate schedule:

- Week 1- Introductions on distribution feeder topologies, distribution primary system, distribution secondary systems
- Week 2- Load characteristics: definitions, metrics and load curves
- Week 3- Load characteristics: Motors
- Week 4- load predictions, Demand-side Management and Electricity Rate
- Week 5-Distribution Automation
- Week 6-Power Systems Basics
- Week 7—Winter Break

- Week 8- Power Systems Basics and Transformers
- Week 9- Transformers
- Week 10-Distribution system performance and operation: voltage drops
- Week 11- Distribution system performance and operation: voltage regulation, capacitor applications
- Week 12-Distribution system power flows
- Week 13-Distribution system Reliability
- Week 14 Review

Laboratory and Problem Analysis Sessions

1 hour as per schedule and location posted on Brightspace.

Notes for Labs

- There are 3 Labs and 2 PA Sessions as follows:
 - Lab 1 (Week 3, 5, 6): V/f Ratio PWM-Inverter Induction-Motor Drive (CB 3104)
 - Lab 2: Power World Software (Week 11)—A Tutorial (CB 3104)
 - Lab 3: Power World Software (Week 12)--A Distribution Feeder System (CB 3104)
 - PA 1 (Week 4): Load Prediction Tutorial: Software Introduction (CB 3104)
 - PA 2 (Week 9): Questions Reviews for the Midterm (CB 3104)
- Labs and PA sessions are 1 hour in duration and will be held in Room CB3104.
- 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.
- Lab reports are normally due one day after each lab. labs are worth 10 marks and must still be handed in. In order to pass SREE3002, it is necessary to complete the three labs. If you miss a lab due to illness or other valid reason you must arrange a time to complete a make-up lab. No laboratory exemptions are given to students who are repeating the course. All laboratory pages are to be printed by the student from BrightSpace. **One day late it will only be worth 50%. Two days late, it is worth 0.**

Self-Declaration form and Deferred Term work

Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for submitting a self-declaration form no later than three (3) days after the date/deadline of term work including test/midterm, labs, assignments. Any alternate arrangements made with the instructor for submission of term work should be made as soon as possible but within 3 days of the missed due date. If this is not possible after discussion with the instructor, alternate arrangements must be made before the last day of classes in the term as published in the academic schedule.

Evaluation and Grading Scheme

The cumulative course grade will be determined as follows:

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|-----------------------------|-----|--------------------------|
| 1) Final exam (Closed-Book) | 50% | |
| 2) Project-Load Forecasting | 20% | Due date: TBD |
| 3) Midterm (Closed-book) | 20% | Due Date: Week 10 |
| 4) Lab reports | 10% | |

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- a) Final Exam: **Final exams are for evaluation purpose and will not be returned to students.**
- b) Deferred Final Examinations: students who are unable to write the final examination because of a serious illness/emergency or other circumstances beyond their control may apply for accommodation by contact the Registrar's office. Consult the Section 4.3 of the University Calendar (<https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/examinations/>)

Learning Outcomes

Upon successful completion of this course, students will be able to:

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

Graduate Attributes

The Canadian Engineering Accreditation Board requires graduates of undergraduate engineering programs to possess 12 attributes: [Graduate-Attributes.pdf \(engineerscanada.ca\)](#) or GA's. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all sections of a course during an academic year) is used for accreditation purposes and to guide improvements to programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate. Accreditation metrics are based on courses common to all students in a program.

This following list provides the GAs that will be measured in this course (SREE 3002), along with the indicators that are intended to develop and assess these attributes.

Graduate Attribute		Indicators
GA-1: Knowledge base for Engineering Level D	DOE-1 Analog Circuits DoE-6 Electromagnetics DoE-8 Energy Conversion and Transmission	Percentage is applied to questions assessing knowledge base in discipline specific knowledge area such as Electrical Engineering.

Academic Integrity and Plagiarism

- a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: <https://carleton.ca/engineering-design/current-students/fed-academic-integrity>. Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

b) One of the main objectives of the Academic Integrity Policy is to ensure that the work you submit is your own. As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source.

Examples of violations of the policy include, but are not limited to:

- Any submission prepared in whole or in part, by someone else;
- Using another’s data or research findings without appropriate acknowledgment;
- Submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own;
- Failing to acknowledge sources of information through the use of proper citations when using another’s work and/or failing to use quotations marks; and
- Unless explicitly permitted by the instructor in a specific course, the use of generative AI and similar tools to produce assessed content (such as text, code, equations, images, summaries, videos, etc.).

Academic Accommodations

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

Pregnancy obligation: Contact us 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 accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form ([click here](#)).

Religious obligation: Contact us 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 [click here](#).

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 us 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, contact us, if needed, to ensure that accommodation arrangements are made.

You should request your academic accommodations in the [Ventus Student Portal](#), for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm.

Please consult the [PMC website](#) for the deadline to request accommodations for formally-scheduled exams (if applicable).

Survivors of Sexual Violence: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <https://carleton.ca/equity/sexual-assault-support-services>

Accommodation for Student Activities: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation will be provided to students who compete or perform at the national or international level. Contact us 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:

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

Use of Course Materials

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