

Department of Electronics
Carleton University

SREE 3002- Electrical Distribution Systems
Winter 2023

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Course Objectives:

This course introduces 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. By the end of the course, students should 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.

Marking Scheme:

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%	

Lecture Topics: The list below indicates possible topics and tentative schedule covered in the course.

- 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: Trending and neural networks
- Week 5-Distributed Generators
- Week 6-Demand Side Management and Electricity Rate
- **Week 7—Winter Break**

- Week 8- Distribution automation: components and architectures
- Week 9- Communication systems for distribution automations: requirements, wireless communication for distribution systems, wired communications for distributions, and existing examples.
- Week 10-Distribution system performance and operation: voltage drops
- Week 11- Distribution system performance and operation: voltage regulation, capacitor applications
- Week 12-Distribution system flows
- Week 13-Distribution system Reliability
- Week 14 Review

Course Delivery:

In Person

Course Textbook:

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

References:

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

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

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

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

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

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

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.

Note:

1. – **Single Cheat Sheet (8½" × 11" page, double sides) can be brought into the Midterm exam!!**
2. The final exam is for evaluation purposes only and will not be returned to students.
3. In addition to having a passing grade for the entire course, students must also have obtained a passing grade in the laboratory portion of the course as well.
4. If you miss the mid-exam without a valid reason, you will receive a grade of 0 on the mid-exam.

Labs:

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 two 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.

Lab 1 (Week 3, 5, 6): V/f Ratio PWM - Inverter Induction - Motor Drive (CB 3104)

Lab 2.0 (Week 11): Power World Software—A Tutorial (CB 3104)

Lab 2.1 (Week 12): Power World Software--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)

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).