

Department of Electronics
Carleton University

ELEC 4602: Electrical Power Engineering
Fall 2020

Instructor: Xiaoyu Wang
Office: 4203 Canal Building
Phone: 613-520-2600 ext. 1049
Email: xiaoyuw@carleton.ca
TAs:

Course Objectives:

This course covers the following contents:

- Modeling of synchronous generators, transformers, transmission lines, and loads
- Power flow
- Power system fault and protection
- Transient stability
- Power system controls
- Power markets
- Power distribution

The main objectives of the course are:

- (1) to help students gain a thorough understanding of the basic concepts and techniques of power system components including synchronous generators, transformers, transmission lines, and loads;
- (2) to provide students with the fundamental knowledge necessary to design power systems;
- (3) to enable students to acquire hands-on experience on control and operation of power systems;
- (4) to give student opportunities to learn industrial cases and to interact with professionals from industry;
- (5) to train students to independently and collaboratively conduct research and present research results.

By the end of the course students should be able to:

- (1) explain principles of the focused power system components, i.e., synchronous generators, transformers, transmission lines and loads;
- (2) calculate power flow of transmission systems;
- (3) calculate symmetrical and unsymmetrical power system faults;
- (4) understand the concept of power system transient stability;

- (5) understand the concept of power system controls including voltage and frequency control, economic dispatch, and optimal power flow;
- (6) review literature, identify questions, discuss solutions, and present results in the research area of power systems.

Course Schedule:

Lecture: 4:05 pm - 5:25 pm, Tuesday and Thursday, **online**

Laboratories: Canal Building (CB) Monday A1 12:35 pm - 2:25 pm remote labs

(Tentative schedule)	PA/Lab	Lecture	Lecture
	Monday (A1)	Tuesday (Lecture No)	Thursday (Lecture No)
Week 1	N/A		0
Week 2	PA 1	1	2
Week 3	Lab demo	3	4
Week 4	Lab 1	5	6
Week 5	Midterm 1	7	8
Week 6	N/A	9	10
Week 7	Lab 1	11	12
Week 8	Fall Break		
Week 9	Lab 2	13	14
Week 10	Lab 2	15	16
Week 11	Midterm 2	17	18
Week 12	Lab 3	19	20
Week 13	Lab 3	21	22
Week 14	PA 2	23	24

Course Textbook:

Textbook Title: Power System Analysis and Design

Textbook Edition: 6th

Textbook Author: J. Duncan Glover, Mulukutla Sarma, Thomas Overbye

Textbook Publisher: Thomson-Engineering

The ISBN number: ISBN-10: 1305632133 ISBN-13: 978-1305632134

Reference Web Sources:

<https://overbye.engr.tamu.edu/course-2/ecen460fa2017/>

<https://courses.engr.illinois.edu/ece476/fa2016/>

<https://www.powerworld.com/gloveroverbyesarma>

Prerequisite(s): ELEC 2501 (Circuits and Signals) and ELEC 2507 (Electronics I)

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.

Marking Scheme:

Final exam	50%	(open book)
1/3 term exam	10%	(open book)
2/3 term exam	10%	(open book)
Labs reports	30%	

Note:

1. The final exam is for evaluation purposes only and will not be returned to students. Textbook and lecture slides can be brought into the final exam and the midterm exams.
2. In the event that you miss the 1/3 term exam or the 2/3 term exam and have a valid reason, the equivalent of the term portion of the final grade will be shifted to the final exam. If you miss any of the term exams without a valid reason, you will receive a grade of 0 on the term exam(s) missed.
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.

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 at the end of the laboratory period. Late labs are worth 0 and must still be handed in. In order to pass ELEC 4602, it is necessary to complete all 3 labs. If you miss a lab due to illness or other valid reason you must arrange a time to complete a make-up lab. All lab results are to be written directly in the space provided in the instruction sheets. A completed lab will include the introduction sheets, instruction sheets and any closing sheets. All is to be stapled together and handed to the TA at the end of the lab period. The TA will also sign you in at the start of the lab and sign you out at the end of the lab. No laboratory exemptions are given to students who are repeating the course. Each laboratory is worth 5% of your final grade. All laboratory pages are to be printed by the student from CULearn.

Lab 1: Three-phase system and synchronous generator

Lab 2: Power flow

Lab 3: Transient stability

PA Session 1: Review of phasors, complex power and three phase power

PA Session 2: Review of course contents

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

Lecture 0: Introduction to power systems
Lecture 1: Power system basics
Lecture 2: Synchronous generators
Lecture 3: Synchronous generators
Lecture 4: Power Transformers
Lecture 5: Transmission line models
Lecture 6: Transmission line models
Lecture 7: Power system loads

Lecture 8: Power flow
Lecture 9: Power flow
Lecture 10: Power flow

Lecture 11: Voltage and frequency control
Lecture 12: Contingency analysis
Lecture 13: Economic dispatch
Lecture 14: Optimal power flow
Lecture 15: Power markets

Lecture 16: Guest Lecture 1

Lecture 17: Symmetrical faults
Lecture 18: Symmetrical components
Lecture 19: Unsymmetrical faults
Lecture 20: System protection

Lecture 21: Transient stability
Lecture 22: Transient stability

Lecture 23: Power distribution

Lecture 24: Guest Lecture 2

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/>