

OCIECE Graduate Course
Advanced Power System Analysis
(ELEC 5303 - 2023 Winter Term)

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Course Objectives:

This course introduces fundamental power system analysis knowledge and skills. The main objectives of the course are:

- (1) to help students gain a thorough understanding of the basic concepts and analysis approaches of power systems;
- (2) to provide students with the fundamental knowledge and analytical skills necessary to conduct power system analysis;
- (3) to enable students to acquire hands-on experience on modeling and simulation of power systems;
- (4) to train students to conduct independent research in the area of power system analysis.

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

- (1) understand and master principles of the main power system components, i.e., synchronous generator, power converters, transformer, load, etc.;
- (2) analyze and simulate the detailed computer simulation models of power systems;
- (3) investigate the main power system control and operation issues, e.g. stability control, voltage control, optimal power flow, etc.;
- (4) review literature, identify questions, propose solutions, and deliver results in the research area of power systems.

Course Schedule:

Lectures: Monday 10:00 am-11:30 am, Wednesday 2:35 10:00 am-11:30 am

Reference material

1. Course lecture notes and slides:
2. Supplementary textbooks:
 - [1] Prabha Kundur, Power System Stability and Control, McGraw-Hill, 1994.
 - [2] PW Sauer, MA Pai, Power system dynamics and stability, Prentice Hall Upper Saddle River, 1998.
 - [3] CW Taylor, Power system voltage stability, McGraw-Hill, 1994.

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:	Mid-term exam	20 %	Take-home exam
	Final exam	30 %	Take-home exam
	Project	50 %	

Note:

1. The requirement on the course project will be provided separately.
2. The computer simulation tool Matlab/Simulink-SimPowerSystems will be needed to do the assignment, the mid-term exam, the project, and the final exam. The computers in the following labs at Carleton University have the license for Matlab/Simulink-SimPowerSystems: Canal Building 3104 (Ottawa Hydro Lab), Mackenzie Building (ME4128, ME4166), Minto Center (MC6030).

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

Week 1	Introduction to power system stability and control
Week 2	Transmission line and transformer model
Week 3	Power flow analysis
Week 4	Synchronous generator model (physical and mathematical description, park transform and equivalent circuit)
Week 5	Synchronous generator model (representation in stability studies, exciter, prime movers)
Week 6	Power system load model (static and dynamic load models, induction motors)
Week 7	Power system small-signal stability (eigenvalue analysis, single-machine infinite bus system analysis, multi-machine system analysis)
Week 8	Mid-Term Exam, Winter Break, University closed
Week 9	Power system small-signal stability (power system stabilizer, wide-area damping control)
Week 10	Power system transient stability (power system transients, swing equation, simulation method, direct method)
Week 11	Power system transient stability (analysis of multi-machine system)
Week 12	Power system voltage stability (mechanism, indicators)
Week 13	Power system voltage stability (analysis of single-machine infinite bus system and multi-machine system)
Week 14	Project

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/>