MEMORIAL UNIVERSITY

Department of Electrical and Computer Engineering
Faculty of Engineering and Applied Science

Course Outline

ENGI 9856

Fall 2021-2022

ENGINEERING 9856: Electrical Power Systems

Instructor	**Mohsin Jamil**	**Teaching Assistants: Mahmoud Elsayed**	
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CALENDAR ENTRY:

9856 Electrical Power Systems begins with the fundamental concepts of electric energy systems engineering. Topics include real and reactive powers, reactive power and complex power, per unit quantities, symmetrical components; modelling of power system components - synchronous generators, power transformer, and power transmission line; single line diagrams; network equations formulation; power flow analysis and control; fault analysis; power system controls; power system stability; introduction to micro grids, smart grids, and integration of renewable energy systems.

COURSE DESCRIPTION:

The objective of the course is to present methods of power system analysis in sufficient depth to give a non-electrical engineering graduate a sound understanding of a broad range of topics related to power system engineering. MATLAB and PowerWorld simulator will be used extensively in the course to reinforce the understanding of the theory and modelling approaches developed in the course.

SCHEDULE: LECTURE: Monday, Wednesday and Friday (11AM-12PM)
Room: EN4008

CREDIT VALUE: 3 credit hours

RESOURCES:

TEXT BOOK AND REFERENCES

- Power System Analysis and Design, Glover/Sarma/Overbye, Cengage Learning, 2012.
- Power System Analysis, J.D.Grainger and W.D.Stevenson, McGraw-Hill, 1994.
- Power System Stability and Control, P.Kundur, McGraw-Hill, 1994
- Electric Energy Systems Theory – An Introduction, Olle I Elgerd, McGraw Hill, 1983

MAJOR TOPICS:

- **Introduction**
- **Fundamentals:** Phasors, instantaneous power, real and reactive power, apparent power, and complex power in single-phase and three-phase circuits; symmetrical components, sequence networks; load characteristics, voltage, and load dependency.
- **Modelling of Power System Components:** the three-phase synchronous generator – terminal voltage, power and torque relationships, real and reactive power control, modelling; the power transformer – equivalent circuits, per unit system, three-phase transformer connections and phase shift, per unit sequence models of three-phase and two-winding transformers, autotransformers, and transformers as a control device; the power transmission line – line resistance and conductance, line inductance, line capacitance, medium and short line approximations, equivalent π circuit, maximum power flow, reactive compensation techniques.
- **Power Flow Analysis and Control:** The power flow problem, power flow solution by Gauss-Seidel and Newton-Raphson methods; computational aspects of large-scale systems, sparsity techniques, PowerWorld simulator; control of power flow.
- **Fault Analysis:** Symmetrical faults, three-phase short circuits, circuit breakers and fuse selection. unsymmetrical faults, single line-to-ground, line-to-line, double line-to-ground faults, sequence bus impedance matrices
- **Power System Controls:** Generator-voltage control, turbine-governor control, load-frequency control; economic dispatch
- **Power System Stability:** Transient stability, the swing equation, equal-area criterion, numerical integration of the swing equation; multimachine stability.
- Introduction to micro grids: Classification, architecture, and control; intelligent micro grids and integration of renewable energy systems.

ASSESSMENTS:

		Approximate Due Dates
Assignments	10%	
Assignment 1		September 27
Assignment 2		October 11
Assignment 3		November 01
Assignment 4		November 15
Midterm Exam	20%	October 20
Project	30%	Stepwise Deadlines
		[Mid Report: Oct 22, Final Report and Present: Nov 22)
Final Exam	40%	TBA (08-17 December 2021)

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Any student found to commit academic misconduct will be dealt with according to the Faculty and University practices. More information is available at http://www.mun.ca/engineering/undergrad/academicintegrity.php

Students are encouraged to consult the Faculty of Engineering and Applied Science Student Code of Conduct at http://www.mun.ca/engineering/undergrad/academicintegrity.php and Memorial

University's Code of Student Conduct at http://www.mun.ca/student/conduct/.

INCLUSION AND EQUITY:
Students who require accommodations are encouraged to contact the Glenn Roy Blundon Centre, http://www.mun.ca/blundon/about/index.php. The mission of the Blundon Centre is to provide and co-ordinate programs and services that enable students with disabilities to maximize their educational potential and to increase awareness of inclusive values among all members of the university community.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue will be collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE:
Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student

COVID-19 RELATED INFORMATION:
Welcome to the fall 2021 term! This course is designed to be held in-person and remotely as well. Our class lectures have been carefully designed to emphasize safety while providing a rich learning experience for all students. Following campus-wide policy, masks are required for all students in our classroom. Should other health directives or the overall situation connected to COVID-19 change over the course of the term, a back-up plan for remote delivery is in place to ensure that the course will continue and to minimize disruption to the student experience

There is nothing more important than your mental and physical health. Doctors' notes are not required for medical absences in this course. You are encouraged to seek appropriate medical attention from the Student Wellness and Counselling Centre. I am committed to working with students with pre-existing medical and mental health needs, as well as new needs that may arise within the semester. I encourage you to reach out to the Blundon Centre as early as possible to discuss any adjustments you think may be necessary in this course. Let's explore the options to help you succeed, no matter what is going on.

If Memorial University campus operations are required to change because of health concerns related to the COVID-19 pandemic, it is possible that this course will rapidly move to a fully online delivery format. Should that be necessary, students will need to have access to a networked PC or Mac computer with webcam and microphone for remote delivery of the class. The university has published minimum computer requirements which you can review.

While the COVID-19 pandemic is slowly subsiding in many parts of the world and vaccination rates are increasing, this is still a stressful time for many. It's important that we support each other and keep informed of current information. The Memorial COVID-19 website is an excellent source of information and support, with specific links for students, supports and services, and health and wellness.