MEMORIAL UNIVERSITY

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

Course Outline

ENGI 9856

Fall 2024-2025

ENGINEERING 9856: Electrical Power Systems

Instructor	**Mohsin Jamil**	**Teaching Assistants: Abu Sufyan**
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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 (4-7PM)
Room: TBA

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**
- **Basics:** Alternating Current Theory, Inductance in AC circuits, Capacitance in AC Circuits, Resonance, Transformers, Polyphase AC
- **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.
- **Modeling of Power System Components:** the three-phase synchronous generator – terminal voltage, power and torque relationships, real and reactive power control, modeling; 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 microgrids**: Classification, architecture, and control; intelligent microgrids and integration of renewable energy systems.

ASSESSMENTS:

		Approximate Due Dates
Quizzes (2)	10%	
Quiz 1		Week 04 (Monday, September 23, 2024)
Quiz 2		Week 08 (Monday, October 21, 2024)
Midterm Exam	20%	Week 10 (Monday, November 04, 2024)
Design Project	30%	Stepwise Deadlines (Proposal-Sep 15, Mid Report-Oct 20,2024) (Final Report and Presentation-25 Nov 24)
Final Exam	40%	TBA (05-13 December 2024)

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