ENGINEERING 9858: Advanced Power Systems

Instructor	**Mohsin Jamil**	**Teaching Assistants: Soroush Esmaeili**
E-mail	**mjamil@mun.ca**	**E-mail: sesmaeili@mun.ca**
Phone	**864-2751**	**Phone :**
Office Location	**CSF-3124**	**Office Location : TBA**
Office Hours	**Mondays, 12:00 – 1:00 pm** **Wednesday, 12:00 – 1:00 pm**	**Office Hours TBD**

Communication **Email: mjamil@mun.ca**

Website **http://online.mun.ca (D2L)**

CALENDAR ENTRY:

9858 Advanced 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 and power quality issues, 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 electrical engineering graduate a sound understanding of a broad range of topics related to advanced 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: Thursday (4-7PM)
Room: EN2040

CREDIT VALUE: 3 credit hours

RESOURCES:

TEXTBOOK 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.
- **Power Quality in Microgrids:** Introduction to micro grids: Classification, architecture, and control; intelligent micro grids and integration of renewable energy systems, Voltage sags and momentary interruptions, Harmonics analysis, Harmonic mitigation methods, Power quality improvement

ASSESSMENTS:

		Approximate Due Dates
Quizzes (4)	10%	Jan 25, Feb 8, Mar 14, Mar 28
Midterm Exams (2)	20%	February 15, March 21
Project	30%	Stepwise Deadlines (Proposal-Jan 10, Mid Report-Feb 26,) (Final Report and Presentation-Mar 29)
Final Exam	40%	TBA (10-19 April 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