MEMORIAL UNIVERSITY

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

Course Outline

ENGI 9857

Spring 2022

ENGINEERING 9857: Instrumentation and Control of Energy Systems

Instructor	**Mohsin Jamil**	**Teaching Assistants: Rasool Kahani**
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Office Hours	**Monday: 12:00-1:00 PM** **Tuesday: 12:00-1:00 PM**	

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CALENDAR ENTRY:

Instrumentation and Control of Energy Systems covers key concepts in automatic control and instrumentation of a number of energy systems. The topics include steady state and dynamic modeling of energy systems, supervisory control and data acquisition for renewable energy system, design of dynamic and supervisory digital controllers, dynamic simulation and analysis, design of data loggers and communication system, site data analysis and future energy production estimates.

SCHEDULE: LECTURE: Monday and Tuesday, 3:30-4:45 PM
Room: EN4008

CREDIT VALUE: 3 credit hours

COURSE DESCIPTION:

Instrumentation and Control of Energy Systems covers key concepts in automatic control and instrumentation of several energy systems. The topics include steady state and dynamic modeling of energy systems, supervisory control and data acquisition for renewable energy system, design of dynamic and supervisory controllers, dynamic simulation and analysis, design of data loggers and communication system, site data analysis and future energy production estimates. Additionally, this course offers to learn and use various tools for the analysis and synthesis of digital control systems for energy systems. A more advanced discussion of instrumentation, analog/digital control systems, introducing many modern control techniques, and implementation issues will be discussed. Students who successfully complete this course should have exposure to instrumentation and digital control design using different methods (e.g. state-space controller) in the filed of energy systems. They will have a basic understanding of various factors which limit the achievable control system performance (e.g. Time delays, Non minimum phase zeros, etc.). Students will also get experience in several implementations of control systems using MATLAB/SIMULINK.

RESOURCES: TEXTBOOK AND REFERENCES

- Power Plant Instrumentation and Control Handbook: A Guide to Thermal Power Plants, Kindle Edition by Swapan Basu, Ajay Debnath, Academic Press 2014.

- Optimal Control of Wind Energy Systems: Towards a Global Approach Munteanu, I., Bratcu, A.I., Cutululis, N.-A.,Ceanga, E., 2008
- Digital Control of Dynamic Systems by Franklin, Powell and Workman
- Control Sensors and Actuators by Clarence W. de Silva, Prentice Hall, 1989.
- Instructor Notes

MAJOR TOPICS:

- Introduction
- System Modelling
- Types of models (deterministic, black box and grey box models)
- Steady state
- Dynamic modelling
- State-space modelling
- Design of dynamic digital controllers
- Pole placement controller
- State space controller
- Continuous and Discrete systems
- Design of supervisory controllers and observers
- Dynamic system simulation and analysis
- Design of data loggers
- Data communication system for energy systems
- System site data analysis and future energy production estimates
- Instrumentation/generalised measurement system (static and dynamic characteristics)
- Interface electronics and signal processing (Instrumentation amplifiers, buffers, differentials, etc.)
- Noise and interference of measurement system
- Data acquisition and display
- Intelligent sensor systems (MEMS)
- Case Studies
- Individual project

ASSESSMENTS:

		Approximate Due Dates
Assignments (3)	08%	
Assignment 1		May 27
Assignment 2		Jun 17
Assignment 3		Jul 15
Quizzes (3)	12%	
Quiz 1		May 30
Quiz 2		Jun 28
Quiz 3		Jul 12
Midterm Exam I	10%	Jun 14
Midterm Exam II	10%	Jul 19
Design Project	25%	Stepwise Deadlines (Proposal, Mid Report, Final Report, Final Presentation)
Final Exam	35%	TBA (Aug 08-Aug 13)

Evaluation Information for MESE Program:

Students must obtain a grade of at least 65% in all program courses to receive credit for the course towards their program requirements. Any student who fails to receive 65% or more in a course, must repeat the course in the case of core courses, or must either repeat or replace the course with another program course in the case of elective courses. Any student who receives a grade of less than 65% in two courses or in a repeated course will be required to withdraw from the program.

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