MEMORIAL UNIVERSITY

Faculty of Engineering and Applied Science

Course Outline

ENGI 5821

Winter 2016

ENGINEERING 5821: Control Systems 1

Instructor	Dr. Siu O'Young
E-mail	oyoung@mun.ca
Phone	864-8345
Office Location	EN-3074
Office Hours	1-1:50pm Monday and Friday

TA / Contact: Jiabin Shen, js2550@mun.ca
Shuyan Chen, sc5714@mun.ca
Shenqi Jiang, sj5062@mun.ca

PREFERRED METHOD OF CONTACT: email

CALENDAR ENTRY:

ENGI 5821 Control Systems 1 includes an introduction to control systems with a negative feedback; mathematical modelling and transfer functions of electromechanical systems; block diagram reduction and signal flow graphs; controller realization using op-amps; transient response analysis; Routh's stability criterion; basic control actions and response of control systems; root locus analysis and design; frequency response analysis; Bode diagram; gain and phase margins; compensator design in frequency domain; Nyquist stability criterion; A/D and D/A conversion, digital implementations of analog compensators; and an introduction to PID controller tuning methods.

PR: ENGI 4823

LH: at least four 3-hour sessions per semester

Credit Value: 3 Credits

Accreditation Units: 42 Combined Educational Hours; Focus: 100% Engineering Sciences

SCHEDULE:

Class:	Mon, Wed, Fri, 2-2:50pm, EN4035
Tutorials:	Tue, 11-11:50am, EN 4035
Labs:	Mon, Wed, 9-11:50am, EN1021C

RESOURCES:

Textbook: Nise, N. S., Control Systems Engineering, 7th Ed., Wiley, 2015

Reference: Ogata, K., Modern Control Engineering, 5th Ed., Prentice Hall, 2009

Notes: Available on D2L

MAJOR TOPICS:

- Overall of Control System
- Modelling of Systems for Design
- Time Domain Response
- Stability
- Steady-State Response
- Design of Control System in Frequency Domain
- Introduction to Industrial Control Practice

ASSESSMENTS:

- Eight assignments (8%), Due every Friday
- Three Labs (15%) Lab 1: Jan 18, 25; Lab 2: Feb 8, 15 and Lab 3: Feb 29, Mar 7
- Midterm (27%) Feb 12, 2016
- Final Exam (50%) TBD

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

	LEARNING OUTCOMES	**GRADUATE ATTRIBUTES. LEVEL OF COMPETENCE**	**Methods of Assessment**
1	Show familiar with the inputs, outputs and components of a control system. Explain the difference between open-loop and closed-loop (feedback) control systems and recall the advantages of feedback control.	1.2, 12.1, 9.1	Assignment and Exams.
2	Apply the utility of Laplace transforms and transfer functions for modeling complex interconnected systems.	1.2	Assignment and Exams.
3	Explain the relationship of poles of a transfer function to the stability of a system, and more generally describe the concept of poles and zeroes of a transfer function and how they affect the physical behavior of a system.	1.2	Assignment, Labs and Exams.

4	Derive mathematical models of a variety of electrical and electro-mechanical systems.	4.2	Assignment, Labs and Exams.
5	Draw the pole-zero diagram and the root loci, which are the change in location of the poles as parameters are of a system are varied.	2.2	Assignment and Exams.
6	Explain the concept of frequency response and the related concepts of bandwidth, disturbance sensitivity, and noise sensitivity. Be able to draw Bode plots and recall their significance.	1.2, 2.2, 3.2	Assignment and Exams.
7	Estimate time response of systems to impulse, step, ramp, and sinusoidal inputs from the transfer function.	2.2, 3.2	Assignment, Labs and Exams.
8	Describe the meaning of proportional control, integral control, and derivative control, lag compensation, and lead compensation, and how to use them to achieve desired stability, steady-state error, and frequency response.	1.2, 2.2, 4.2	Assignment, Labs and Exams.
9	Construct simple feedback circuits using op-amps.	4.2	Assignment, Labs and Exams.

See www.mun.ca/engineering/undergrad/graduateattributes.pdf for more information on the 12 Graduate Attributes you are expected to be proficient in upon graduation.

Each Graduate Attribute for each learning outcome is rated at a level of proficiency between 1 and 3 (1=introductory, 2=intermediate, 3=sophisticated).

LAB SAFETY:

Students are expected to demonstrate awareness of, and personal accountability for, safe laboratory conduct. Appropriate personal protective equipment (PPE) must be worn (e.g. steel-toed shoes, safety glasses, etc.) and safe work practices must be followed as indicated for individual laboratories, materials and equipment. Students will immediately report any concerns regarding safety to the teaching assistant, staff technologist, and professor.

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.engr.mun.ca/policies/codeofconduct.php and Memorial University's Code of Student Conduct At http://www.mun.ca/student/home/conduct.php.

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.