ECE 5200: Control Systems I

Instructor **Mohsin Jamil**

Teaching Assistants: 1. Usman Ashraf
2. Nushen Senevirathna
3. Syed Mohammad Mousavi
4. Mirza Jabbar Baig

E-mail **mjamil@mun.ca**

E-mail: 1. uashraf@mun.ca
2. msenevirathn@mun.ca
3. smmousavi@mun.ca
4. mjabaig@mun.ca

Phone **864-2751**
Office Location **EN-3031**
Office Hours **Monday: 9:00– 10:10 am**
Wednesday: 9:00 – 10:10 am
Communication **Email: mjamil@mun.ca**

Phone :
Office Location : TBA
Office Hours TBD

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

CALENDAR ENTRY:

5800 Control Systems I includes an introduction to control systems with negative feedback; mathematical modelling and transfer functions of electromechanical systems; block diagram and signal flow graphs; controller realization; 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; digital implementations of analog compensators; and an introduction to PID controller tuning methods.

PR: ECE 4600-Introduction to Systems and Signals
LH: four 3-hour sessions per semester

CO: ECE 5300-Electronic Circuits II

Lab Experiments:

Six lab experiments are completed by each individual student under the supervision of teaching assistants. Students perform analysis and design of control systems, implement control, and debug and test the circuit using MATLAB/Simulink. Written report needs to be submitted by each student by the due date.

Lab 1: Using MATLAB for Control Systems (Week 2: 11/13 January 2021); Lab Report Due: 22 January
Lab 2: Linear Time Invariant Systems and Representation using MATLAB (Week 4: 25/27 January 2021)
Lab 3: Block Diagram Reduction using MATLAB (W6: 8/10 February 2021)
Lab 4: Mathematical Modeling of 1st and 2nd Order Systems using MATLAB (W9:1/3 March 2021)
Lab 5: Time Response Analysis of 1st and 2nd Order Systems using MATLAB (W11:15/17 March 2021)
Lab 6: Implementation of PID Controller using MATLAB (W13:29/31 March 2021)

CREDIT VALUE: 3 credit hours

COURSE TYPE: Compulsory

ACCREDITATION UNITS: 3/1/1

CONTENT CATEGORIES:

Math	Natural Science	Complementary Studies	Engineering Science	Engineering Design
			100%	

SCHEDULE: LECTURE: Monday, Wednesday, Friday 2:00-02:50 pm, Room: Online
TUTORIAL: Tuesday 12:00-12:50pm, Room: Online
LABS: Monday and Wed 9:00am-12:00pm, Room: Online

RESOURCES:

TEXTBOOK

Nise, N.S. Control Systems Engineering, 8th Ed., Wiley, 2019

Reference:

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

MAJOR TOPICS:

- Introduction to Control Systems
- Modelling of Systems for Control Design
- Time Domain Response
- Stability
- Steady-state Response
- Design of Control System in Frequency Domain
- Introduction to Industrial Control Practices

LEARNING OUTCOMES:

Course Level Graduate Attribute Focus: KB-D, PA-A, Inv.-D

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

	LEARNING OUTCOMES	GRADUATE ATTRIBUTES. LEVEL OF COMPETENCE	METHODS OF ASSESSEMENTS
1	Recognize the inputs, outputs and components of a control system	KB-I, PA-I	Assignments Labs, and Exams.
2	Explain the difference between open-loop and closed-loop control systems and recall the advantages of feedback control.	KB-I, PA-I	Assignments, Labs and Exams.
3	Derive mathematical models of a variety of electrical and electro-mechanical systems.	PA-D, Inv-D	Assignments, labs and Exams.

4	Estimate time response of systems to impulse, step, ramp, and sinusoidal inputs from the transfer functions.	PA-I, Inv-D	Assignments, Labs and Exams.
5	Apply the utility of Laplace transforms and transfer functions for modeling complex interconnected systems.	PA-D, Inv-D	Assignments and Exams.
6	Explain the relationship of poles of a transfer function to the stability of a system and how they affect the physical behavior of a system.	KB-D, Inv-D	Assignments, Labs and Exams.
7	Investigate the steady-state error of a feedback system to different reference input signals.	Inv-D, Des-I Tools-A	Assignments, Labs and Exams.
8	Draw the pole-zero diagram and the root loci of a system transfer function	Inv-A, PA-D Tools-A	Assignments and Exams.
9	Design of feedback systems using the root-loci method.	PA-D, Des-A Tools-A	Assignments and Exams.
10	Draw the frequency response of a system using the Bode plot method.	Inv-D, Tools-D	Assignments and Exams.
11	Design feedback systems using frequency response methods and explain the tuning of PID controller	Des-A, Tools-A	Assignments, Labs and Exams.

Each Graduate Attribute for each learning outcome is rated at a Content Instructional Level of I=Introductory, D=Developed, or A=Applied).

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

ASSESSMENT:

		Approximate Due Dates
Assignments (4)	12%	
Assignment 1		January 29
Assignment 2		February 19
Assignment 3		March 19
Assignment 4		April 02
Quizzes (2)	12%	
Quiz 1		February 04
Quiz 2		March 18
Midterm Test	20%	Thursday, Mar 04
Lab Work (6)	18%	Detail and schedule given separately.
Final Exam	38%	TBD (April 14-April 23)

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 www.engr.mun.ca/undergrad/academicintegrity.
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.
Individual work is expected of each student. Even if students work in groups, or discuss with others, assignments and reports should be independently prepared.

INCLUSION AND EQUITY:
Students who require physical or academic accommodations are encouraged to speak privately to the instructor so that appropriate arrangements can be made to ensure your full participation in the course. All conversations will remain confidential.
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.