

MENG 283: Control Systems

Course Outline

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Lectures: **Grp 1A/1B** – M (8.30 – 9.20) in CBA 271 & W (8.30 – 9.20) in TEC 173
Grp 2A/2B – M (13.30 – 14.20) in CBA 209, W (14.30 – 15.20) in CBA 271

Labs (TEC 135): **Grp 1A** – Th (12.30 – 15.20); **Grp 1B** – Tu (8.30 – 11.20)
Grp 2A – Tu (12.30 – 15.20); **Grp 2B** – Th (8.30 – 11.20)

Office Hours: M (12.30 – 13.20), Tu & Th (11.30 – 12.20), W (13.30 – 14.20)

Course Description: Students will be introduced to the terminology, concepts, principles, procedures and computations used by engineers and technologists to analyze, select, specify, design and maintain a variety of control systems. Laboratories and assignments will consider computer, electronic, mechanical, and electro-mechanical elements and be used to construct working microcontroller-based control systems. As well, students will gain experience using purchased industrial control modules. Computer software will be used to model and simulate the control systems. PID control modes will be detailed.

Offered:	Academic Term 3 (Fall)
Credit:	3
In-class workload:	2 hrs Lecture, 3 hrs Lab
Out-of-class workload:	5 hrs
Prerequisites:	MENG 181, ECET 149, MATH 193

COURSE OBJECTIVES:

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

1. Understand various fundamental types of control systems and describe how they work using block diagrams and transfer functions
2. Apply analog and digital principles to control system operation and design
3. Mathematically analyze control systems
4. Program a microcontroller to control both discrete and continuous processes
5. Understand how various types of industrial controllers operate

COURSE OUTLINE:

1. Introduction to Control Systems
 - a. Block Diagrams and Transfer Functions
 - b. Open-loop & Closed-loop control
 - c. Benefits & Objectives of good control system
 - d. Load and Set-point changes
 - e. Instability and Damping

2. Types of Control
 - a. Event-driven Control
 - b. Sequential Control
 - c. Process Control
 - d. Regulator and Follow-up Systems
 - e. Servo Control
 - f. Analog and Digital Control
3. Digital Fundamentals & Applications in Control
 - a. Numerical Systems & Conversion
 - b. Logic Elements and Boolean Algebra
 - c. Data Acquisition
 - d. Analog to Digital Conversion (ADC)
 - e. Digital to Analog (DAC) conversion and Pulse Width Modulation (PWM)
4. System Modeling & Analysis
 - a. Water level control system
 - b. Mass-Spring system
 - c. Mass Spring-Damper system
5. Control of continuous processes
 - a. Proportional Integral Derivative (PID) controllers
 - b. Advanced controllers
6. Introduction to Motion control systems

TEXTBOOKS:

No textbook is required for this course. All necessary material will be provided in classroom notes and handouts on the course website.

IMPORTANT NOTES:

- Refer to course website on a regular basis for updates and deadlines
- All assignments & lab reports are to be submitted prior to working on final project
- **All students are responsible for obtaining their own Lab kits from the bookstore and bringing them to the Lab every week. Failure to do so may result in loss of Lab privileges.**

MARKING SCHEME:

1.	Assignments:	20%	2.	Midterm:	35%
3.	Lab work:	20%	4.	Final Project:	25%

GRADING SCHEME (COLLEGE POLICY):

A+	90-100%	B-	70-72%
A	85-89%	C+	65-69%
A-	80-84%	C	60-64%
B+	77-79%	D	50-59%
B	73-76%	F	0-49%