Université d'Ottawa
Faculté de génie

École d'ingénierie et de technologie de l'information

uOttawa

L'Université canadienne
Canada's university

University of Ottawa
Faculty of Engineering

School of Information Technology and Engineering

ELG4157/ SYS5100 Modern Control Syllabus, Winter2025

Type	Date & Time	Location
A00: lectures	Tuesday 7:00PM - 9:50PM	100 Louis Pasteur (CRX) C442
A01: Lab	Wednesday 7:00PM - 9:50PM	161 Louis Pasteur (CBY) B402
A02: Lab	Thursday 7:00PM - 9:50PM	161 Louis Pasteur (CBY) B402
A03: Tutorial	Friday 4:00PM - 5:20PM	550 Cumberland (TBT) 333
A04: Office Hours	Thursday 10:00 - 11:30 AM	800 King Edward Ave (SITE) 5.5000D

Contact Information

Instructor: Hitham Jleed (hjleed@uottawa.ca)
TAs: Majid Moghaddam (mghos045@uOttawa.ca), James Sarker (jsarker@uottawa.ca), and Abhay Gaur (agaur040@uOttawa.ca)

Course Information

This course provides a comprehensive introduction to advanced control system concepts and methodologies, with a focus on modern state-space techniques and their practical applications. Students will gain theoretical and practical knowledge in state-space modeling, controllability, observability, feedback design, digital control systems, and optimal control. Additional topics include nonlinear control and intelligent control techniques, emphasizing their relevance to industrial and engineering applications.

Prerequisite
ELG3155: Introduction to Control Systems

Technology Requirements
Slides and lectures will be posted on the course's Brightspace, along with tutorials, labs, and exercises. Access to MATLAB is mandatory. You can use university computers or access MATLAB via uOlabsPlus on personal devices

Acknowledgment

Some materials for this course, including lecture slides and lab activities, have been adapted from the work of Professor Riadh Habash with his permission.

Course Objectives

By actively engaging in this course, you will:

1. Recognize, analyze, and solve problems in linear and nonlinear control engineering.
2. Appreciate professional responsibilities and good engineering practices while working individually or collaboratively.
3. Apply sustainability principles and interdisciplinary approaches in designing modern control systems.
4. Enhance communication skills through technical and professional presentations.
5. Employ advanced control strategies to solve real-world engineering problems.

Course Content

- **Introduction to State-Space Modeling:** Representing dynamic systems in the time domain, system characteristics, and performance analysis.
- **Controllability and Observability:** Fundamental concepts and their role in control system design.
- **Feedback Control Design:** State-space methods for controller design, pole placement, and system stabilization.
- **Optimal Control:** LQR techniques for achieving desired system performance.
- **State Observers:** Design and implementation of state observers, including Kalman filters.
- **Digital Control Systems:** Sampling, discrete-time system analysis, and digital implementation of controllers.
- **Advanced Topics:** Nonlinear control strategies and emerging intelligent control techniques.

ℹ️ The course requires knowledge about algebra, Laplace, and fundamentals of Control Engineering. You can review my old courses:

- ELG3125 Signal and System Analysis: ELG3125 Webpage OR Course GitHub (e.g., algebra & Laplace)
- ELG3155 Introduction to Control Systems: Course GitHub (e.g., Fundamentals of Control Engineering)
- ELG4177 Digital Signal Processing: ELG4177 Webpage OR Course GitHub (e.g., Z-transform)

References

Textbook: Readings will be from the Textbook: Nise, N. S. (2019). ***Control systems engineering*** **(8th ed.).** John Wiley & Sons. ISBN: 978-1-119-47422-7

Additional Resources: Free End of Chapter Problems ; Free Solutions to Skill-Assessment Exercises; Google Book Review ; Free Book MATLAB Codes

In addition, it is helpful to read the **following references**:

- Franklin, Gene F., et al. (2018). ***Feedback Control of Dynamic Systems*** (8th ed.). Pearson. ISBN: 0134685717.
- Ogata, K. (1995). ***Discrete-time control systems*** (2nd ed.). Prentice-Hall, Inc. ISBN: 978-0-13-034281-2, 0133286428, 978-0-13-328642-7
- Lewis, Frank L., et al.(2012) ***Optimal Control***. (3rd Edition)., Wiley. ISBN: 978-0-470-63349-6

ℹ Helpful resources for you to understand more:
Explore texts assigned in other courses around the world such as:

- Stanford University: (Robust Control Analysis and Synthesis) https://lall.stanford.edu/engr210a/lectures.html
- MIT: (Dynamic Systems and Control) https://ocw.mit.edu/courses/6-241j-dynamic-systems-and-control-spring-2011/pages/readings/
- University of Colorado: (Lecture notes and recordings for ECE4510/5510: Feedback Control Systems) http://mocha-java.uccs.edu/ECE4510/index.html

Coursework and Grading Scheme

- **Lab :Design Simulation 1 {15%} (Individual or Group of 2) (Feb 07, 2025)**
- **Lab :Design Simulation 2 {15%} (Individual or Group of 2) (March 14, 2025)**
- **Midterm 1 {15%} (Individual, in-class exam) (February 11, 2025)**
- **Midterm 2 {10%} (Individual, take-home exam) (March 18, 2025)**
- **Closed-book Final Exam {25%} (TBD) (3hr-exam)**
- **Course Project {20%} divided to:**
  - Project Proposal -- - -- (February 25, 2025)
  - Project Simulation {10%}
  - Project YouTube/Educational presentation {5%} (April 01, 2025)
  - Project Article {5%} (April 01, 2025)

On Brightspace, you can find mor information about the course project, course calendar, and lab/tutorial activities.
Note: course attendance is required

Course Policies

Late Assignments

- Late submissions incur a 5% penalty per day, up to 3 days. Assignments more than 3 days late receive a grade of zero.
- Absences or missed exams require an online "Declaration of Absence" through the university portal. The first declaration is automatically approved, while subsequent declarations require supporting documentation. (Regulation A-8.6. Justification of absence from an examination or of late submission of assignments)

Academic Integrity.

All submissions must adhere to the University's Academic Integrity Policy. The use of AI tools like ChatGPT without explicit permission is prohibited and considered academic fraud.

Course Privacy Statement.

According to the University of Ottawa policies, Class materials and recordings are for personal use only and must not be uploaded or shared without permission.

> ℹ The materials you receive for this course are protected by copyright and to be used for this course only. You do not have permission to upload the course materials, including any lecture recordings you may have, to any website.
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Academic Accommodations

Students requiring adaptive measures should contact the Academic Accommodations office by:

- Submitting an intake form via the Academic Accommodations Portal (Ventus)
- Calling 613-562-5976
    - **Midterm Requests:** 7 business days before the exam
    - **Final Exam Requests:** Deadline: March 15, 2025

Academic Regulation A-1 on Bilingualism

Except in programs and courses for which language is a requirement, all students have the right to produce their written work and to answer examination questions in the official language of their choice, regardless of the course's language of instruction.