EML 4312 : Control of Mechanical Systems

Class Periods: M,W,F 2nd period (0830-0920)
Location: FLG 0260
Academic Term: Spring 2025

Instructor
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Office Hours in NEB 427 : M,W (1355:1445)

Teaching Assistants

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Course Description
(3 credits) Theory, analysis and design of control system, including mechanical, electromechanical, hydraulic, pneumatic and thermal components and systems.

Pre-requisites and Co-requisites
EGM 3401 and MAP 2302

Course Objectives
This course will demonstrate the principles used to control the behavior of dynamical systems. Students will learn how to represent dynamics using both time-domain concepts and frequency-domain concepts and characterize behaviors using metrics such as rise time. Most importantly, techniques to use sensor measurements in feedback will be introduced to change those behaviors.

Materials and Supply Fees
none

Relation to Program Outcomes (ABET)

	Outcome	Coverage
(1)	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	HIGH
(2)	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	LOW
(3)	an ability to communicate effectively with a range of audiences	LOW
(4)	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
(5)	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
(6)	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
(7)	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks and Software

- A textbook is not required
- Some assignments will require the use of MATLAB.

Recommended Material

- Katsuhiko Ogata, "*Modern Control Engineering*", Prentice-Hall, 2010, ISBN 978-0-13-615673-4

Required Computer

- Recommended : https://it.ufl.edu/get-help/student-computer-recommendations/
- Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Course Schedule

A tenative schedule of the lectures is identified along with associated reading assignments. This schedule may change in response to student interactions so the class will be notified of any substantial changes.

Date	Pages	Topic
Aug 22		syllabus
Aug 25	63-72	introduction
Aug 27	859-866	Laplace
Aug 29	15-17	transfer function
Sep 03	161-175	transfer function
Sep 05	398-402	Bode plots
Sep 08	403-415	Bode plots
Sep 10	17-28	block diagrams
Sep 12		exam review
Sep 15		homework01
Sep 17		exam01
Sep 19		dynamics
Sep 22		dynamics
Sep 24		dynamics
Sep 26	212-218	Routh criterion
Sep 29		parametrization
Oct 01	269-275	root locus
Oct 03	276-281	root locus
Oct 06	282-287	root locus
Oct 08	303-307	design
Oct 10		exam review
Oct 13		exam review
Oct 15		homework02
Oct 20		exam02
Oct 22		stability
Oct 24		actuator effect
Oct 27	218-221	integral control
Oct 29		actuator effect
Oct 31	222-224	derivative control
Nov 03	308-310	root locus design
Nov 05	568-577	Ziegler Nichols
Nov 07	462-468	margins
Nov 10		assign project
Nov 12		exam review
Nov 14		homework03
Nov 17		exam03
Nov 19		discussion
Nov 21		discussion
Dec 01		office hours
Dec 03		office hours

Attendance and Expectations
Students will need to know the material from each lecture so attendance, while not mandatory, is strongly advised. The entirety of exams and homeworks are constructed based on content and concepts presented in these lectures so you will not be properly prepared if you do not attend class. The lectures and recommended textbooks are meant to present complementary approaches and examples so the textbooks are supplementary to, but not replacements for, the lectures. Also, some lectures may have unannounced in-class quizzes. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies at `https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies`

Evaluation of Grades

tentative date	event	course value
	EXAMS	60%
September 17	exam01	(10%)
October 20	exam02	(25%)
November 17	exam03	(25%)
	HOMEWORK	25%
September 15	homework01	(5%)
October 15	homework02	(10%)
November 14	homework03	(10%)
	PROJECT	15%
December 03	project	(15%)

Grading Policy
Grades will be determined based on a curve that reflects the level of difficulty for each submission. This curve is not based on class performance or the student average; instead, the curve is determined before the exam is given based on the amount of partial credit allowed for each solution.

Grade Evaluation
Any exam for which a student wants the grade to be evaluated must be given to the instructor within 48 hours, and before the start of the subsequent lecture, of when the graded exams were available to the class.

Cheating Policy
Exams must strictly reflect your own work so any use of unauthorized materials (other students, notes, phones, computers, books) will be strictly penalized. Cheating on an exam will be reported to the Dean of Students Office with a recommendation of grade of 0 for the entirety of that exam.

Homework Submission
Homework are due by the start of class. Due dates are not extended. Late submissions will not be accepted.

Academic Policies and Resources
`https://go.ufl.edu/syllabuspolicies`

Commitment to a Positive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu