

# EML 4312 : Control of Mechanical Systems

**Class Periods:** M,W,F 7th period (1355-1445)

**Location:** CSE 121

**Academic Term:** Fall 2021

## Instructor

Rick Lind

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Office Hours : T (0935:1130)

## Teaching Assistants

Alex Benvenuti

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Robert Martinez

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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. Similarly, aspects of system behavior will be characterized using metrics such as rise time and steady-state error. 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	MEDIUM
(7)	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	LOW

## Required Textbooks and Software

- Katsuhiko Ogata, “*Modern Control Engineering*”, Prentice-Hall, 2010, ISBN 978-0-13-615673-4
- Some assignments will require the use of MATLAB.

## Course Schedule

The course will essentially consist of 3 sections. The first section will utilize the Laplace transform to generate models that represent dynamics and note their behavior across frequencies. The second section will describe the use of feedback and introduce a method to design controllers to modify the dynamics of a system. The third section will introduce additional aspects of feedback that expand the range of achievable behaviors for the dynamics of a system.

## On-Line Course Recording

Our class sessions may be audio-visually recorded. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

**Attendance and Expectations** Students are expected to attend every lecture. The lectures and textbook are meant to present complementary material such that similar topics are presented using different approaches and examples. Exams are constructed based on content and concepts presented in these lectures. Also, in-class quizzes may be offered but students are required to be in attendance to participate.

## Evaluation of Grades

The students are expected to understand the theories behind system analysis and feedback control along with having an ability to apply those theories to problems. Course grades will reflect such understanding and ability through a distribution of exams and homework.

tentative date	event	course value
	EXAMS	65%
September 17	exam01	(15%)
October 22	exam02	(25%)
November 19	exam03	(25%)
	HOMEWORK	20%
September 15	homework01	( 4%)
October 20	homework02	( 8%)
November 15	homework03	( 8%)
	PROJECT	15%
December 6	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 assigning.

## 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.

## Missed-Exam Policy

Students may request approval to miss an exam for academic/professional reasons as long as the request is submitted at least 2 weeks before the exam. The student will take an exam, which will be different from the rest of the class, before their absent date.

### **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **Course Evaluation**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### **In-Class Recording**

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### **University Honesty Policy**

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code”. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

**Commitment to a Safe and Inclusive Learning Environment** The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

**Software Use** All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

**Student Privacy** There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulat>.

### Campus Resources

- Health and Wellness
  - **U Matter, We Care:** Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.
  - **Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
  - **Sexual Assault Recovery Services (SARS):** Student Health Care Center, 392-1161.
  - **University Police Department:** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.
- Academic Resources
  - **E-learning technical support:** 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu). <https://lss.at.ufl.edu/help.shtml>.
  - **Career Resource Center:** Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.
  - **Library Support:** <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.
  - **Teaching Center:** Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.
  - **Writing Studio:** 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.
  - **Student Complaints Campus:** [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).
  - **On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.