ORTA DOĞU TEKNİK ÜNİVERSİTESİ

Syllabus
Electrical and Electronics Engineering - 5670302
Feedback Systems, Fall 2020

Instructors & Schedule:

Section 1	Section 2	Section 3	Section 4
M. M. Ankaralı	K. Leblebicioglu	E. Özkan	A. Saranlı
Mon.: 09:40-10:30	Mon.: 09:40-10:30	Mon.: 13:40-15:30	Mon.: 13:40-15:30
Wed.: 09:40-11:30	Wed.: 09:40-11:30	Wed.: 11:40-12:30	Wed.: 11:40-12:30
EA-209	EA-208	EA-206	EA-312
mertan@metu	kleb@metu	emreo@metu	afsars@metu

Scope: This course aims to reinforce systems and mathematical modeling concepts; to develop a solid understanding of stability and feedback notions; and to expose students to feedback controller design for linear systems.

Prerequisite: EE301 Signals and Systems I.

Teaching Assistants

Mehmet Cetinkaya	Barkın Tuncer	Elif Sarıtas	Lütfullah Tomak
cemehmet@metu	barkin.tuncer@metu	esaritas@metu	ltomak@metu

Main Text Book:

[**M**] N.S. Nise, Control Systems Engineering (6th Ed.), Wiley, 2011.

Auxiliary sources:

[**A1**] K. Ogata, Modern Control Engineering (5th Ed.), Pearson, 2010.

[**A2**] M. M. Ankarali, Open Source Lecture Notes on Feedback Systems, METU.
https://github.com/mertankarali/Lecture-Notes/tree/master/METU-EE302

[**A3**] E. Kocaoglan, Lecture Notes on Linear Control Systems, METU.

[**A4**] Control Tutorials for MATLAB and Simulink (CTMS). http://ctms.engin.umich.edu/

[**A5**] E. Özkan, EE302 Feedback Systems Teaching Blog. https://blog.metu.edu.tr/emreo/ee-302-feedback-systems/

Web-page: The course will be maintained through ODTUClass. Please check that you have your active e-mail address registered in ODTUClass. (https://odtuclass.metu.edu.tr/)

Course Grading

Midterm 1	% 27
Midterm 2	% 27
Final Exam	% 36
Homeworks	% 8
Attendance	% 2
Bonus Project	% 5

Attendence: Students must attend the section in which they are registered.

Make-up Exam:' One make-up exam will be granted only to those with an official excuse, e.g., a valid medical report. The make-up exam will cover all subject matter.

Final and NA Criteria: The students who fail to take both MT1 and MT2 without an official excuse will not be allowed to take the final exam and will directly get the NA grade.

Bonus Project: At the end of the semester we are going to apply a two- step grading process as follows: The letter grades will first be assigned without considering the project grades and the letter grade boundaries will be determined. Then the bonus project grades will be added to the overall grades. After the addition, if a students grade crosses an upper-grade boundary, then the student will get a higher letter grade. In this way the letter grades of the students who did not participate in the project will not be affected by the letter grades of those who did.

We will announce the technical and schedule related details regarding the project later.

Tentative Outline & Schedule

Week	Outline	[M]	[A1]
1	1. Introduction (~1 hr)	1	1
	2. Mathematical Modeling (~ 7 hrs)	2.1-2.9	2.1-2.5
2	a) Electrical Circuits, Mechanical Systems, DC Motor	3.1-3.6	3
	b) System representations and block diagrams	5.1-5.4	
3	3. Time Domain Analysis (~4 hrs)		
	a) Transient response	4.1-4.8	5.1-5.4
4	b) Steady-state error	7.1-7.4	5.7-5.8
	c) Effects of PID control		
5	4. Stability & Root-locus (~7 hrs)		
	a) Routh-Hurwitz test	6.1-6.4	5.6
6	b) Root locus	8.1-8.7	6.1-6.3
	c) Root loci for PID controllers		
7	5. Frequency Response Analysis (~6 hrs)		
	a) Nyquist criterion		
8	b) Relative stability	10.1-10.8	7.1-7.13
	6. Design in Frequency Domain (~8 hrs)	11.1-11.4	
10	a) Lead compensation		
	b) Lag compensation		
11	7. State-Space Analysis (~5 hrs)		
	a) State-space equations from transfer functions		9.1-9.2
12	b) Canonical forms	5.7	9.6-9.7
	c) Controllability and observability	12.1-12.7	10.1-10.2
13	8. State Feedback & Luenberher Observer (~4 hrs)		10.5-10.7
	a) State feedback & pole placement		
14	b) Luenberger observer design		

Ethics

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of homework assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded projects and exams, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.
In addition, the specific ethics guidelines for this course are:

(1) Homeworks are not team projects, and thus working together on homeworks is NOT ALLOWED. The final output should reflect your OWN individual effort.

(2) If you stuck at a problem (or problems), you can ask for some help from your friends. However, it must be at the conceptual level and your collaborator(s) must be acknowledged on your take home exam. In other words you can not share anything other than ideas, such as write-ups, sample codes (for computational problems). DO NOT COPY. Your solutions should come from your brain not your friend's paper.

(3) While working on your final write-ups for homeworks, you may **refer** to your own class notes, text-books, online related sources, etc.

(4) Disclosure of Outside Sources: If you use outside sources other than your class notes and your text books to solve problems (i.e. if you have used sources such as online sources) then you must disclose the outside source and what you took from the source in your writeup. THIS IS GENERALLY OK – just disclose your sources.

Report any violations you witness to the instructor.