Instructor: Zak M. Kassas

Office: WCH 319
Phone: 951-827-5652
Email: zkassas@ece.ucr.edu
Course Webpage: Available through iLearn
Office Hours: Tue., 6:30 pm – 8:00 pm, and by appointment
Teaching Assistant: Kimia Shamaei, ksham002@ucr.edu
TA Office Hours: Mon. 1:00 pm – 2:30 pm and Fri. 1:00 – 2:30 pm, WCH 109

Lectures: Tue. & Thu., 5:10 pm – 6:30 pm, Bourns Hall Room A125
Labs: Wed. 2:10 pm – 5:00 pm and Wed. 6:10 pm – 9:00 pm; WCH 125 & 126

Text: R.C. Dorf and R.H. Bishop, *Modern Control Systems*, Prentice Hall, 13th Edition, 2016

Suggested References:

- N.S. Nise, *Control Systems Engineering*, Seventh Edition, 2015
- G.F. Franklin, J.D. Powell, and A. Emami-Naeini, *Feedback Control of Dynamic Systems*, Seventh Edition, Prentice Hall, 2014
- K. Ogata, *Modern Control Engineering*, Fifth Edition, Prentice Hall, 2009
- K. Astrom and R. Murray, Feedback Systems: An Introduction for Scientists and Engineers, First Edition, Princeton University Press, 2008. This text is available to download from http://www.cds.caltech.edu/~murray/amwiki

Prerequisites: EE 105: Modeling and Simulation of Dynamic Systems or ME 103: Dynamics or equivalent; EE 110A: Signals and Systems or ENGR 118: Engineering Modeling and Analysis; or consent of instructor

Course Objective: This course develops an understanding of the theory of automated control systems and its applications. Topics covered include: systems modeling, stability analysis, and time and frequency domain feedback control design techniques.

Homework Assignments: Homework assignments will be assigned on a regular basis and will be due at the beginning of the lecture. Late submissions will **not be accepted** (unless it is the result of an officially excused absence). You may discuss homework problems with other students, but you are **not** allowed to copy from others. If you decide to discuss your solutions with other student(s), you must provide the name(s) of the student(s) with whom you have worked. University disciplinary procedure will be invoked if **any** form of cheating is detected. The lowest homework assignment grade will be dropped.

Exams: There will be two midterm exams and a final. Missed exams may **not** be made up (unless it is the result of an officially excused absence).

Laboratories: There will be accompanying software- and hardware-based laboratories.

Attendance and Course Policy: Attendance is expected. You are responsible for material covered in class and in the reading assignments.

Tentative Topical Coverage:

Week	Date	Topics	Chapters
1	04/04, 04/06	**Introduction:** Definitions, control system design cycle **Mathematical Models of Systems:** Classification of systems, Linearization, Laplace transform	1 2
2	04/11, 04/13	**Mathematical Models of Systems:** Transfer functions, block diagrams **State Variable Models:** State variable representations, state differential equation, time- and frequency-domain relationships	2 3
3	04/18, 04/20	**Feedback Control Systems Characteristics:** Error signal analysis, sensitivity of control systems to parameter variations, disturbance rejection, noise attenuation	4
4	04/25, 04/27	**Midterm 1** **Performance of Feedback Control Systems:** LTI systems response to test input signals, performance of feedback control systems: first-order, second-order, and higher-order systems	 5
5	05/02, 05/04	**Performance of Feedback Control Systems:** Transient response analysis, basic system identification **Stability of Linear Systems:** Routh-Hurwitz stability criterion, stability of state variable systems	5 6
6	05/09, 05/11	**Root Locus Method:** Root locus concept, root locus design	7
7	05/16, 05/18	**PID Control:** Properties, realization, design methods **Frequency Response Methods:** Frequency response plots, gain and phase margins	Notes 8
8	05/23, 05/25	**Midterm 2** **Design of Feedback Control Systems:** Cascade compensation networks, lead compensator design via Bode diagrams and root locus	 10
9	05/30, 06/01	**Design of Feedback Control Systems:** Lag compensator design via Bode diagram and root locus **Design of State Variable Feedback Systems:** Controllability, observability	10 11
10	06/06, 06/08	**Design of State Variable Feedback Systems:** State-feedback design, observer design, integrated full-state feedback and observer	11
11	06/10	**Final Exam**	

Grading:

Homework Assignments	15%
Laboratory Reports	20%
Midterm Exams	30%
Final Exam	35%

Final Grade Assignment:

A+: $\geq$ 97%, A: $\geq$ 93%, A–: $\geq$ 90%, B+: $\geq$ 87%, B: $\geq$ 83%, B–: $\geq$ 80%, C+: $\geq$ 77%, C: $\geq$ 73%, C–: $\geq$ 70%, D+: $\geq$ 67%, D: $\geq$ 63%, D–: $\geq$ 60%, F: $<$ 60%