

USC Viterbi School  
of Engineering

**AME 451: Linear Control Systems I**  
Fall 2015 – Mon, Wed 5:00-6:15 pm  
**Location:** SOS B46

**Instructor:** Serkan Kalender, Ph.D.  
**Office:** SOS B47  
**Office Hours:** Mon, Wed 6:30-8:30 pm  
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**Course Description:**

Transform methods, block diagrams; transfer functions; stability; root-locus and frequency domain analysis and design; state space and multiloop systems

**Prerequisite(s):**

AME 302, MATH 245

**Required Textbook:**

R. Dorf and R. H. Bishop, Modern Control Systems , 12th Edition, Prentice-Hall, 2011.

**Recommended Textbook:**

**Feedback Control of Dynamic Systems**, Gene F. Franklin, J. Da Powell, Abbas Emami-Naeini

**Grading Breakdown**

Assignment	% of Grade
Homework	20
Midterm Exam	30
Final Exam	50
<b>Total</b>	<b>100</b>

**Assignment Submission Policy:**

Homework assignments that are turned in late will be accepted, but they will be marked down for each passing day.

**Make-up Policy:**

No make-up exams will be given without **prior** approval and then only for emergency purposes.

**Disclaimer:**

The instructor reserves the right to change, revise, and / or update the syllabus at any time during the semester if the need arises.

**Topics to be covered:**

- Introduction and Overview
- Review of Modeling of
  - Mechanical Systems
  - Electrical Systems
  - Fluid and Thermal Systems
  - Electromechanical Systems
- Review of Laplace and Inverse Laplace Transformation
- Transfer Function and State-Space Representation of Dynamic Systems
- Block Diagrams and Block Diagram Transformations
- Feedback Control System Characteristics
  - Open versus closed loop control systems
  - Sensitivity of feedback systems to parameter variations
  - Transient Response
  - Disturbance signals in feedback control systems
  - Effect of pole/zero locations on transient response
  - Relation between steady-state errors and system type
- Stability of Linear Systems
  - Definition of Stability
  - Routh-Hurwitz Stability Criterion
- Root-Locus Analysis/Design
- Frequency Domain Analysis
  - Frequency Response of Linear Systems
  - Bode and Nyquist Diagrams
  - Nichols plots
- Frequency Domain Stability Analysis
  - Nyquist Stability Criterion
  - Phase and Gain Margin
  - Performance measures in Frequency Domain
- Control Design and Compensation Techniques
  - Lead, Lag, Lead-Lag Compensation
  - Control Design using Matlab/Simulink

## **Academic Conduct**

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://capsnet.usc.edu/departement/departement-public-safety/online-forms/contact-us>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

## **Support Systems**

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.