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
Contact Info:
e-mail: serkank@deltatau.com
Phone: 818-826-3979

Teaching Assistant: Xiufeng Yang
Office: VHE 202
Office Hours: T.B.D.
e-mail: xiufeng@usc.edu

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:

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

Grading Breakdown

<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of Grade</th>
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<tbody>
<tr>
<td>Homework</td>
<td>20</td>
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<tr>
<td>Midterm Exam</td>
<td>30</td>
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<tr>
<td>Final Exam</td>
<td>50</td>
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<td>Total</td>
<td>100</td>
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**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/department/department-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 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.