Louisiana Tech University
Department of Electrical Engineering

ELEN 472/ELEN 572 – Introduction to Digital Control

Course Information — Winter 2016

Description:	Sampling theory, data reconstruction, *z*-transforms, stability analysis, time-domain analysis, frequency domain analysis, state-space analysis, Root Locus method.
Instructor:	Dr. Rastko R. Selmic, Email: rselmic@latech.edu, Web: http://www.latech.edu/~rselmic/Courses/ Tel: 318-257-4641, Office: Tech Pointe 208B.
Class Hours:	TR, 8:00 am – 9:50 am, NETH 120
Office Hours:	MTWRF 10:00am – 12:00pm or by appointment
Prerequisites:	ELEN 471 – Automatic Control Systems
Textbook:	*Digital Control Engineering,* M. Fadali and A. Visioli, Academic Press, Elsevier, Burlington, MA, USA, 2009.
Additional Reference:	*Discrete-Time Control Systems*, 2nd Edition, K. Ogata, Prentice Hall, Upper Saddle River, New Jersey, 1995.
Recommended Software:	MATLAB and Control Systems Toolbox
Grading:	There will be a homework, project, presentation, mid-term exam and final exam. If you have a question on grading of an assignment or an exam, please contact the instructor about your question within one week of the time the grade is received. Grade weighting: - Homework: 20% - **Project and presentation: 15%; Plagiarizing the project will result in minus 15% (-15%).** - Mid-term Exam: 30% (closed book and notes), Thursday, January 21 - Final Exam: 35% (closed book and notes), Tuesday, February 23. Scale used: A = 100-90%, B = 89-80%, C = 79-70%, D = 69-60%, F = below 60%.
Projects and Presentations:	Research project, proposal due Thursday, January 7. Students need to write a paper in IEEE format, and present it in class. Paper is due on Thursday, February 18. The paper should be 4 pages long, double column, following strict IEEE standard including references. Example of the format: http://www.ieee.org/conferences_events/conferences/publishing/templates.html

No late proposals or papers will be accepted. There will be -5% of project part of the grade subtracted for every day that the project or paper is late.

Graduate Students: In addition to the research project described above, graduate students are required to complete IEEE format paper with proper literature review that will include a table of the recent important results and comparison of described methods.

Tests: All tests will be closed book and closed notes. You will be allowed to bring one sheet of notes (8.5" x 11") one side for the final exam, and a calculator. Students will be required to clear the memory of the calculator prior to beginning the test. No make up exams unless approval is obtained prior to the scheduled test date.

Homework: Weekly homework will be assigned. Homework will be graded. No late homework will be accepted. Some homework may require computer simulation using MATLAB.

Other Policy:

a. Class attendance is governed by the university regulations published each year in the university bulletin (page 26).
b. In the event of the appeal, student is responsible for keeping all original graded materials (exams, homework, and projects).
c. Students with disabilities needing testing or classroom accommodations based on a disability are encouraged to discuss those needs with instructor as soon as possible. Please check www.latech.edu/ods for assistance.
d. In accordance with the Academic Honor Code, students pledge the following: "Being a student of higher standards, I pledge to embody the principles of academic integrity."
e. Emergency Notification System (ENS): All Louisiana Tech students are strongly encouraged to enroll and update their contact information in the Emergency Notification System. It takes just a few seconds to ensure you're able to receive important text and voice alerts in the event of a campus emergency. For more information on the Emergency Notification System, please visit http://ert.latech.edu.

Course Topics:

1. Overview of Continuous-Time Control Systems
2. Introduction to Discrete-Time Control Systems
    a. Quantization
    b. A/D and D/A converters
3. Z-Transform
    a. Z-transform
    b. Inverse Z-transform
4. Reconstructing Original Signals
5. The Pulse Transfer Function
6. Realization of Digital Controllers
    a. PID Controllers
    b. IIR Filters
    c. FIR Filters
7. Mapping Between the S-plane and Z-plane
8. Stability Analysis
    a. Jury Stability Test
9. Transient and Steady-state Analysis
10. Root Locus Method
11. State-Space Analysis
12. Advanced Topics:
    a. Pole Placement and Observer Design
    b. Quadratic Optimal Control Systems
    c. Intelligent Control Systems
    d. Neural Networks
    e. Polynomial Equations Approach