ECSE-4510: Digital Control Systems
SPRING 2011

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Office hours: Monday, Wednesday; 4-5pm

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Office hours: Tuesday, 9-11am

Classroom: JEC 4104/ Tuesday,Friday; 14:00 – 15:20

Credit hours: 3 units

Textbook: C. L. Phillips and H. T. Nagle, *Digital Control System Analysis and Design,* Prentice-Hall, 1995, 3rd ed. (required)
J. H. Chow, D. K. Frederick, and N.W. Chbat, *Discrete-Time Control Problems using MATLAB and the Control System Toolbox,* Brooks/Cole, 2003 (optional/recommended)

Website: RPI LMS

Grading:

Homework (7/8 sets)	20%
Quizzes (3 times)	40%
Final exam	30%
Class project	10%

Prerequisites: ECSE 2410 (Signal and Systems) or equivalent. Familiarity with MATLAB.

Rules/policy

- There is a class e-mail list. Make sure you are included in the list by signing up with the instructor.
- Attendance is not compulsory. However, every student registered for this class is subject to the same requirements and grading policy, regardless of attendance.
- Consult the syllabus for quiz and homework dates. These dates are fixed. Please avoid scheduling interviews or trips on these dates.
- The lowest homework grade will be dropped. You can use this to accommodate job interviews, or any other unexpected personal disruptions to your schedule.
- All homework sets are due in class, one week after the handout/posting date, unless specified otherwise.
- Late homework must be submitted directly to the grading TA. Every late day is subject to 20 pts penalty. Homework that is more than 3 day late will not be accepted.
- Class project may be performed by teams of at most 2 students. You are free to choose your partner. Individual work is also allowed.

- All quizzes and exam are closed book. No calculator or other electronic equipments will be allowed.

Course Content

Sampling, quantization, and reconstruction of signals. Mathematical tools used in the modeling, analysis, and synthesis of discrete-time control systems. Analysis tools include z-transforms, difference equation solutions, state variables, and transfer function techniques. Design tools include digital PID controller, root locus, bilinear transformations, compensation techniques and full-state feedback. Applications to sampled-data control. In this course, some computation tasks will be done with MATLAB.

Learning Outcomes:

The students are expected to:

- understand the concept and use of z-transform and difference equations in discrete-time system analysis
- understand the concept and use of mathematical tools for discrete-time controller design

Statement of academic integrity:

The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and the students should make themselves familiar with these. All homework, quizzes and exam are expected to be individual work. You are allowed to work together for the homework. However, the writing must be your own (copying is not acceptable). One instance of unacceptable collaboration or plagiarism will result in 0 point for the work. A second instance of academic dishonesty will result in failure of the course.

Tentative Course Outline:

Nr	Day	Date	Topic	Textbook	Assignments
1	Tuesday	25-Jan	Course overview, z-transform	1.1 - 1.3, 1.5	
2	Friday	28-Jan	z-transform (cont'd)	2.1 - 2.4	
3	Tuesday	1-Feb	Inverse z transform	2.6	HW1 out
4	Friday	4-Feb	Final and initial value theorem, complex poles	2.4	
5	Tuesday	8-Feb	Difference equation solutions	2.5	HW2 out
6	Friday	11-Feb	State variables	2.8	
7	Tuesday	15-Feb	Modal decomposition	2.9	HW3 out
8	Friday	18-Feb	Transfer functions	2.10	
9	Tuesday	22-Feb	Solutions to state equations	2.11	
10	Friday	25-Feb	**Quiz 1**		
11	Tuesday	1-Mar	The ideal sampler	3.1 - 3.6	
12	Friday	4-Mar	Data reconstruction	3.7	HW4 out
13	Tuesday	8-Mar	A/D and D/A conversion	3.8 - 3.9	
14	Friday	11-Mar	Sampled-data control systems and the pulse transfer function	4.1 - 4.4	
X	Tuesday	15-Mar	NO CLASS		

X	Friday	18-Mar	NO CLASS		
15	Tuesday	22-Mar	State variable models	4.8 - 4.12	
16	Friday	25-Mar	Closed-loop systems	5.1 - 5.3	HW5 out
17	Tuesday	29-Mar	System response	6.1 - 6.5	
18	Friday	1-Apr	Digital Controller Design		
19	Tuesday	5-Apr	**Quiz 2**		
20	Friday	8-Apr	Digital Controller Design		
X	Tuesday	12-Apr	NO CLASS		
21	Friday	15-Apr	Stability	7.2, 7.4 - 7.5	
22	Tuesday	19-Apr	Root locus	7.6	HW6 out
23	Friday	22-Apr	Bilinear transformation	7.3	
24	Tuesday	26-Apr	Compensation	8.1 - 8.5	HW7 out
25	Friday	29-Apr	Compensation	8.1 - 8.5	
26	Tuesday	3-May	Full state feedback		HW8 out
27	Friday	6-May	Reserved		
28	Tuesday	10-May	**Quiz 3**		Project due