

**ECSE-4510 – DISCRETE TIME SYSTEMS  
FALL 2008**

**Instructors:** Professors Joe Chow and Lester Gerhardt

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**Class Hours:** Tuesday, Friday - 12:30-1:50 PM

**Room:** JEC 4304

**Office & Phone:** JEC 7026, x6374 (Chow), JEC 3002, x6203 (Gerhardt)

**Office Hours:** Chow (Monday, Thursday, 3:30 pm-4:30 pm), Gerhardt (Tuesday, Friday, 9:00-10:00 am)

**TA:** Fangxu Dong (email: [dongf@rpi.edu](mailto:dongf@rpi.edu)). Office hours: Monday, Thursday, 4:30-5:30 pm, JEC 6037, Flip-Flop Lounge

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

**Books on Reserve in the Main Library:**

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|-----|----------------------------|---|
| 1.  | Cadzow:                    | <u>Discrete Time Systems</u>  |
| 2.  | Cadzow and Martens:        | <u>Discrete-Time Signals and Systems</u>                                  |
| 3.  | Ahmed and Natarajan:       | <u>Discrete-Time Signals and Systems</u>                                  |
| 4.  | Franklin and Powell:       | <u>Digital Control of Dynamic Systems</u>                                 |
| 5.  | Oppenheim and Schaffer:    | <u>Discrete-Time Signal Processing</u>                                    |
| 6.  | Oppenheim and Schaffer:    | <u>Digital Signal Processing</u>  |
| 7.  | Astrom and Wittenmark:     | <u>Computer Controlled Systems</u>  |
| 8.  | Strum and Kirk:            | <u>First Principles of Discrete Systems and Digital Signal Processing</u> |
| 9.  | Oppenheim, Willsky, Young: | <u>Signals and Systems</u>  |
| 10. | Frederick and Chow         | <u>Feedback Control Problems</u>  |
| 11. | Feuer and Goodwin:         | <u>Sampling in Digital Signal Processing and Control</u>                  |

<b>Grading:</b>	Homework:	20%
	Test 1:	20%
	Test 2:	20%
	Final Exam:	30%
	Computer Project 1:	5%
	Computer Project 2:	5%

**Homework:** Homework due as noted on course outline. 20% penalty for each session late. Submission will **NOT** be accepted if more than two sessions late.

**Solutions:** Solutions to homework and tests will be scanned and emailed to you. Copies of past test solutions will also be available.

**Evaluation and Feedback:** There is continuous feedback to the student in this course, in terms of grades received in the homework assignments, the exams given and the computer projects. Moreover, the student is always welcome to see Profs. Gerhardt and/or Chow at any time during the semester.

**Add/Drop:** Students who want to add/drop this course should contact Professor Chow, JEC 7026.

**Prerequisites:** ECSE-2410 Signals and Systems

**Course Content:** Sampling, quantization, reconstruction of signals, digital filters. Mathematical tools used in the modeling, analysis, synthesis and application of discrete-time communication and control systems. These include z-transform, discrete Fourier transform, state-variable, and transfer-function techniques. Applications to sampled-data control and quantized-data communication systems.

### DTS Fall 2008 Course Outline

Dates	Topics	Reference	Professor	Assignment
08/26 (T)	DTS Overview	Ch.1	Gerhardt	
08/29 (F)	Difference eqns and z-transform	2.1-2.6	Chow	
09/02 (T)	State variables	2.7-2.8	Chow	
09/05 (F)	State equation solutions	2.9,2.11	Chow	HW#1 due
09/09 (T)	Transfer functions	2.10,2.12	Chow	
09/12 (F)	Sampling	3.1-3.6	Chow	HW#2 due
09/16 (T)	A/D and D/A conversion	3.8-3.9	Gerhardt	
09/19 (F)	Open-loop transfer functions	4.1-4.4	Chow	HW#3 due
09/23 (T)	State variable models	4.8-4.12	Chow	
09/26 (F)	Closed-loop transfer functions	5.1-5.5	Chow	HW#4 due
09/30 (T)	System response	6.1-6.5	Chow	
10/03 (F)	Reconstruction and Quantization	3.7, 14.1-14.4	Gerhardt	HW#5 due
10/07 (T)	Characteristic eqns, stability	7.1-7.6	Chow	
10/10 (F)	Specifications and compensation	8.1-8.3	Chow	
10/17 (F)	<b>Test #1</b>			
10/21 (T)	Digital control design	Notes/8.11	Chow	HW#6 due
10/24 (F)	Bode plots	7.8-7.10	Chow	
10/28 (T)	Frequency-domain design	8.5-8.9	Chow	
10/31 (F)	Sampled-data transformation	11.1-11.4	Gerhardt	Comp. Proj. #1 due
11/04 (T)	Digital filter structures	12.1-12.5	Gerhardt	
11/07 (F)	Discrete Fourier Series	Notes	Chow	HW#7 due
11/11 (T)	DFT and FFT	Notes	Chow	
11/14 (F)	<b>Test #2</b>			
11/18 (T)	IIR filters	Notes	Gerhardt	HW#8 due
11/21 (F)	FIR filters	Notes	Gerhardt	
11/25 (T)	Direct digital filter implementation	Notes, 14.6-14.8	Gerhardt	
12/02 (T)	Digital communication systems	Notes	Gerhardt	Comp. Proj. #2 due
12/05 (F)	Digital comm. Applications	Notes	Gerhardt	
12/10--12/16	<b>Final exam week</b>			

**No class:** Sept. 1, Oct. 13, Nov. 26-28, Dec. 8-9 (study days)

**Note:** Oct. 14 follows a Monday schedule.