

ECE 416 Digital Control Spring 2019

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Lab Instructor: Section 001: Saptarshi Das; E-mail dassapta@egr.msu.edu
Section 003: Haojun Wang; E-mail wanghao9@msu.edu

Lecture Schedule: Tu Th 1:50 – 2:40, Room A128 Wells Hall

Lab Room: 3230A EB

Office Hours: Tu Th 15:00 – 16:00 (If you have conflict with the scheduled office hours, send e-mail to Lixin Dong to arrange for other times)

Textbooks: M.S. Fadali and A. Visioli, Digital Control Engineering: Analysis and Design, 2nd Ed., Elsevier, 2013. An electronic copy is available through the MSU library at the link:
<http://www.sciencedirect.com.proxy1.cl.msu.edu/science/book/9780123943910>
N.S. Nise, Control Systems Engineering; 7th Ed, 2015

References: K.J. Astrom and B. Wittenmark, Adaptive Control, 2nd Ed, Prentice Hall, 1995.
H.K. Khalil, Nonlinear Control, Pearson, 2015.

D2L: The following materials will be posted on D2L (d2l.msu.edu).

- Lecture notes
- Homework assignments (one week before the due date)
- Homework solutions (after the due date)
- Lab manuals (one week before the lab). Read before the lab.
- Sample exams

Grading:

Grading is assigned using the straight scale shown below, with 2/3 of the score for the lecture and 1/3 for the lab.

Score	90-100%	82-89%	75-81%	68-74%	60-67%	52-59%	45-51%
Grade	4.0	3.5	3.0	2.5	2.0	1.5	1.0

Points for the lecture portion are distributed as follows.

Homework	Exam 1	Exam 2	Exam 3	Total
25%	25%	25%	25%	100%

Points for the lab portion are distributed as follows.

Lab Performance	Reports	Quizzes	Exam	Total
35%	35%	10%	20%	100%

Homework Policies:

- Homework will be due one week after it is assigned.
- Homework will be collected using Assignment Submission Folders (dropbox) with D2L and is due at 11:00 pm. Only single pdf files will be accepted. Unreadable files will not be graded and the student will not be allowed to re-upload after the due date. You must make sure that the uploaded file is readable. Points will be deducted for late homework as follows:
 - Homework received 15 minutes after due => 10 points deducted
 - Homework received 30 minutes after due => 30 points deducted
 - Homework received one hour or more after due => homework not accepted (score of zero entered)--Dropbox will be shut down at 12:00 am.
- The lowest homework grade will be dropped.

Lab Policies:

- Read the lab manual before the lab, do the pre-lab assignments, and answer the pre-lab questions. Some of these questions will be included in a ten-minute, closed-book quiz given in the beginning of the lab. There is no makeup for students who arrive late or those who are absent.
- Lab reports should be **typed**. If it is not convenient for you to type mathematical equations or draw block diagrams, these parts of the report can be hand written.
- Each lab team submits one report.
- The due date of the lab report is the Thursday of the week following the lab. For the week preceding the spring break, the report is due on the first Thursday after the break.
- **Make-up labs may be arranged at the discretion of the lab instructor, but they are not guaranteed. If you are seriously ill you must contact the lab instructor before you miss the lab. You cannot submit a report for a missed lab.**

Exam Policies and Schedule

- All exams are closed book (formulas are provided).
- Schedules (Tentative. Changes will be informed two weeks before the exams if any)

Exam 1: Tuesday, February 5, 1:50 – 2:40 (covers Lectures 1 – 8)
Exam 2: Thursday, March 14, 1:50 – 2:40 (covers Lectures 9 – 16)
Exam 3: Tuesday, April 23, 1:50 – 2:40 (covers Lectures 18– 25)
Lab Exam: Thursday, April 25, 1:50 – 2:20

Important: Please read the Spartan Code of Honor at
<http://asmsu.msu.edu/initiatives/spartan-code-of-honor/>

Approximate Lecture Plan

Lecture #	Date	Topic	Textbook Reading	Homework Due
1	Tu 1/8	Digital Control	Chapter 1	
2	Th 1/10	Discrete-time Systems	Chapter 2	
3	Tu 1/15	Digital Control Systems	Chapters 3 & 4	
4	Th 1/17			HW1
5	Tu 1/22			
6	Th 1/24			HW 2
7	Tu 1/28	Digital Control Design	Chapters 5 & 6	
8	Th 1/31	Review		HW 3
	Tu 2/5	Exam 1		
9	Th 2/7	Digital Control Design	Chapters 5 & 6	
10	Tu 2/12			
11	Th 2/14	Continuous-time State Models	7.1-7.5	
12	Tu 2/19			HW 4
13	Th 2/21	Stability & Feedback Control	Lecture notes	
14	Tu 2/26			HW 5
15	Th 2/28	Nonlinear Systems	Chapter 2 of Khalil	
		Spring Break		
16	Tu 3/12	Review		HW6
	Th 3/14	Exam 2		
17	Tu 3/19	ROTPEN	Lecture notes	
18	Th 3/21	Discrete-time State Models	7.6-7.9 & 8.1	
19	Tu 3/26			
20	Th 3/28	Feedback Control	9.1-9.3 & 9.6	
21	Tu 4/2	Identification	Chapter 2 of A&W	HW 7
22	Th 4/4	Identification	Chapter 2 of A&W	
23	Tu 4/9	Quantization	Chapter 12 & notes	HW 8
	Th 4/11	No class		
24	Tu 4/16	PID Controller	Chapter 12 & notes	
25	Th 4/18	Implementation	Chapter 12 & notes	HW 9
	Tu 4/23	Exam 3		
	Th 4/25	Lab Exam		

Laboratory Plan

Week	Date	Lab
1	1/8 – 1/10	Before you start
2	1/15 – 1/17	Lab 1: DC Motor-Modeling
3	1/22 – 1/24	Lab 2: DC Motor-Speed Control
4	1/29 – 1/31	Lab 3: DC Motor-Position Control
5	2/5 – 2/7	Lab 4: Labview-Simulation
6	2/12 – 2/14	Lab 5: Labview-Control
7	2/19 – 2/21	Lab 6: HVAC-On-off Control
8	2/26 – 2/28	Lab 7: HVAC-PI Control
		Spring Break
9	3/12 – 3/14	Lab 8: Digital Control-Emulation
10	3/19 – 3/21	Lab 9: Digital Control-Discrete Design
11	3/26 – 3/28	Lab10: VTOL I
12	4/2 – 4/4	Lab 11: VTOL II
13	4/9 – 4/11	Lab 12: ROTPEN I
14	4/16 – 4/18	Lab 13: ROTPEN II
15	4/23 – 4/25	Makeup Week
	4/25	Lab Exam