EE 16B | Designing Information Devices and Systems II
Fall 2016

Calendar

Wk	Date	Lecture Topic	Section	Lab	Homework
0	08/23 Tu	No lecture			Homework 0
	08/25 Th	Circuits/Intro	Section 0B: Algebra and op-amp review (dis/0B/)		
1	08/30 Tu	Circuits - transistors (lec/Lecture1A.pdf)	Section 1A: Numbers and transistors (dis/1A/)	Introduction to Debugging (lab/debug.zip)	Homework 1
	09/01 Th	Circuits - RC transients (lec/Lecture1B.pdf)	Section 1B: Complex numbers (dis/1B/)		
2	09/06 Tu	Circuits - inductors and 2nd order ODEs (lec/Lecture2A.pdf)	Section 2A: RC circuits (dis/2A/)	Digital to Analog Converter (lab/dac.zip)	Homework 2
	09/08 Th	Circuits - phasor domain (lec/Lecture2B.pdf)	Section 2B: RLC circuits and second-order equations (dis/2B/)		
3	09/13 Tu	Circuits - transfer functions (lec/Lecture3A.pdf)	Section 3A: Phasors (dis/3A/)	Analog to Digital Converter (lab/adc.zip)	Homework 3

Wk	Date	Lecture Topic	Section	Lab	Homework
	09/15 Th	Circuits - bode plots (lec/Lecture3B.pdf)	Section 3B: Transfer functions (dis/3B/)		
4	09/20 Tu	Control - State space representation (lec/Lecture4A.pdf)	Section 4A: Bode plots (dis/4A/)	Mystery Circuit and Assembly of Mic Boards (lab/mystery_mic.zip)	Homework 4
	09/22 Th	Control - Linearization and stability (lec/Lecture4B.pdf)	Section 4B: Change of basis (dis/4B/)		
5	09/27 Tu	Control - stability continued (lec/Lecture5A.pdf)	Section 5A: Midterm review	Color Organ: Part I (lab/colororgan.zip)	Homework 5
	09/29 Th	Control - predicting system behaviour from eigenvalues (lec/Lecture5B.pdf)	Section 5B: Linearization (dis/5B/)		
6	10/04 Tu	Control - controllability (lec/Lecture6A.pdf)	Section 6A: System stability (dis/6A/)	Color Organ: Part II (lab/colororgan.zip)	Homework 6
	10/06 Th	Control - state feedback control (lec/Lecture6B.pdf)	Section 6B: Controllability (dis/6B/)		
7	10/11 Tu	Control - state feedback control, continued (lec/Lecture7A.pdf)	Section 7A: Block diagrams (dis/7A/)	Mic Circuit: Part I (proj/proj-mic.zip)	Homework 7
	10/13 Th	Control - outputs, observability, and observers (lec/Lecture7B.pdf)	Section 7B: Open loop feedback control (dis/7B/)		

Wk	Date	Lecture Topic	Section	Lab	Homework
8	10/18 Tu	Control - observers continued (lec/Lecture8A.pdf)	Section 8A: Controller canonical forms (dis/8A/)	Mic Circuit: Part II (proj/proj-mic.zip)	Homework 8
	10/20 Th	SVD - overview and demo (lec/8B/)	Section 8B: Observers and observability (dis/8B/)		
9	10/25 Tu	SVD - procedure (lec/Lecture9A.pdf)		Introduction to Controls: Part I (proj/proj-controls.zip)	Homework 9
	10/27 Th	SVD - geometric interpretation (lec/Lecture9B.pdf)			
10	11/01 Tu	Sampling/Interpolation		Introduction to Controls: Part II (proj/proj-controls.zip)	
	11/03 Th	Sampling/Interpolation			
11	11/08 Tu	Sampling/Interpolation		SVD/PCA	
	11/10 Th	Sampling/Interpolation			
12	11/15 Tu	Sampling/Interpolation		Advanced Controls	
	11/17 Th	Wireless			
13	11/22 Tu	Wireless			
	11/24 Th	Thanksgiving break - NO LECTURE			
14	11/29 Tu	Wireless		Integration	
	12/01 Th	Wireless			

Wk	Date	Lecture Topic	Section	Lab	Homework
15	12/06 Tu	Review I			
	12/08 Th	Review II			
16	12/13 Tu	3-6pm Final Exam			
	12/15 Th	No lecture			

Weekly Schedule

Homework

- Homework #0 (due 29 August 2016) (hw/hw0/prob0.pdf) (solutions (hw/hw0/sol0.pdf)) (grading form (grade/hw0.html))

- Homework #1 (due 6 September 2016) (hw/hw1/prob1.pdf) (solutions (hw/hw1/sol1.pdf)) (grading form (grade/hw1.html))
- Homework #2 (due 12 September 2016) (hw/hw2/prob2.pdf) (solutions (hw/hw2/sol2.pdf)) (grading form (grade/hw2.html))
- Homework #3 (due 19 September 2016) (hw/hw3/prob3.pdf) (solutions (hw/hw3/sol3.pdf)) (grading form (grade/hw3.html))
- Homework #4 (due 26 September 2016) (hw/hw4/prob4.pdf) (solutions (hw/hw4/sol4.pdf)) (grading form (grade/hw4.html))
- Homework #5 (due 3 October 2016) (hw/hw5/prob5.pdf) (solutions (hw/hw5/sol5.pdf)) (grading form (grade/hw5.html))
- Homework #6 (due 10 October 2016) (hw/hw6/prob6.pdf) (ipynb (hw/hw6/prob6.ipynb)) (solutions (hw/hw6/sol6.pdf)) (ipynb-solutions (hw/hw6/sol6.ipynb)) (grading form (grade/hw6.html))
- Homework #7 (due 17 October 2016) (hw/hw7/prob7.pdf) (solutions (hw/hw7/sol7.pdf)) (grading form (grade/hw7.html))
- Homework #8 (due 24 October 2016) (hw/hw8/prob8.pdf) (solutions (hw/hw8/sol8.pdf)) (grading form (grade/hw8.html))
- Homework #9 (due 31 October 2016) (hw/hw9/prob9.pdf) (ipynb (hw/hw9/prob9.zip))

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Please add berkeley.edu to the end of all emails

Resources

Midterms

Midterm 1 (note/midterm1.pdf) (solutions (note/midterm1_sol.pdf))
Midterm 2 (note/midterm2.pdf)

Lecture Videos

Note that you need to be logged into your @berkeley.edu account to view these videos.
Lecture 0B (https://www.youtube.com/watch?v=ryhVMlsoFxo)
Lecture 1A (https://www.youtube.com/watch?v=9ODfXZmnz1s)
Lecture 1B (https://www.youtube.com/watch?v=g_-WmfjbCY8)
Lecture 2A (https://www.youtube.com/watch?v=55DcflqAC-g)
Lecture 2B (https://www.youtube.com/watch?v=JCxDWBdTFYk)
Lecture 3A (https://www.youtube.com/watch?v=gJj8I03XDJw)

Lecture 3B (https://www.youtube.com/watch?v=mpzV8G9qjC8)
Lecture 4A (https://www.youtube.com/watch?v=6BoBj-WfynM)
Lecture 4B (https://www.youtube.com/watch?v=iifFSJdkhKg)
Lecture 5A (https://www.youtube.com/watch?v=lJ6KBPpa_Eg)
Lecture 5B (https://www.youtube.com/watch?v=PfzB8WNhPe8)
Lecture 6A (https://www.youtube.com/watch?v=kYPy2cHVTjA)
Lecture 6B (https://www.youtube.com/watch?v=s6lCL5s8JnQ)
Lecture 7A (https://www.youtube.com/watch?v=DIa_YE-DOV8)
Lecture 7B (https://www.youtube.com/watch?v=fH8QNJWBSZk)
Lecture 8A (https://www.youtube.com/watch?v=I7HnXH00_WA)
Lecture 8B (https://www.youtube.com/watch?v=qeAl7tH3nKo)

Video Notes

Intro to transistors and digital logic (https://www.youtube.com/watch?v=Pp7qYJU1mrA)
RC transients (https://www.youtube.com/watch?v=OTbiywzWyPw)
Differential equations (https://www.youtube.com/watch?v=B4Db-wiW5EM)
Linearization (https://www.youtube.com/watch?v=Dy6LG_69iQ4)
Observers and observability (https://www.youtube.com/watch?v=Q1H-1Ciu554)

Lab

Lab outline and overview (lab/outline.pdf)
Intro to Circuits Debugging (https://www.youtube.com/playlist?list=PLEg8HmMqzz48gt7nVY9NHSPnHloYRfFyL)

Circuits

Charge (note/circuits/Charge.pdf)
Current (note/circuits/Current.pdf)
Voltage (note/circuits/Voltage.pdf)
Kirchoff's laws (note/circuits/Kirchoff.pdf)
Parallel and series resistors (note/circuits/ResistorsInSeriesAndParallel.pdf)
Voltage and current dividers (note/circuits/VoltageAndCurrentDividers.pdf)

Linear Algebra

Eigenvalues and eigenvectors (note/linalg/EigenvaluesEigenvectors.pdf)
Change of basis and diagonalization (note/linalg/BasisAndDiagonalization.pdf)

DFT

Interactive guide to the DFT (http://betterexplained.com/articles/an-interactive-guide-to-the-fourier-transform/)
Another textbook chapter (http://terpconnect.umd.edu/~jzsimon/enee222/ref/enee241text0708.pdf) (starts on page 144)
Fourier visualizations (http://bgrawi.com/Fourier-Visualizations/)

PCA, SVD

A tutorial on PCA (https://www.cs.princeton.edu/picasso/mats/PCA-Tutorial-Intuition_jp.pdf)
A linear algebra review that concludes with SVD (https://www.ling.ohio-state.edu/~kbaker/pubs/Singular_Value_Decomposition_Tutorial.pdf)
An article about SVD and its applications (http://www.ams.org/samplings/feature-column/fcarc-svd)
Image processing with the SVD (http://math.mit.edu/~gs/linearalgebra/linearalgebra5_7-1.pdf)
Visualization of the PCA (http://setosa.io/ev/principal-component-analysis/)
Visualization of k-means (http://tech.nitoyon.com/en/blog/2013/11/07/k-means/)

Frequency Response and Impedance

Controls

Murray and Astrom (http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page)Franklin, Powell, and Workman (http://www.amazon.com/Digital-Control-Dynamic-Systems-Edition/dp/0201820544)

(http://www.amazon.com/Digital-Control-Dynamic-Systems-Edition/dp/0201820544)
(http://www.amazon.com/Digital-Control-Dynamic-Systems-Edition/dp/0201820544)

Policies

Grade Breakdown

- Homework: 10%
- Labs: 30%
- Midterm 1: 15%
- Midterm 2: 15%
- Final: 30%

Homework Party

Every week there will be a "homework party." This is completely optional. GSIs will be present in shifts as will some readers. Students are expected to help each other out, and if desired, form ad-hoc "pickup" homework groups in the style of a pickup basketball game.

Homework Grading

The primary way that the homework will be graded is by yourselves. Homework is always due Mondays at noon. You need to turn in both your code in the form of an ipynb file and a .pdf file consisting of your written-up solutions that also includes a "printout" of your code.

After the HW deadline, official solutions will be posted online and then you will be expected to read them and enter your own scores and comments for every part of every problem in the homework on a simple coarse scale:

0 = didn't attempt or very very wrong,
2 = got started and made some progress, but went off in the wrong direction or with no clear direction,
5 = right direction and got half-way there,
8 = mostly right but a minor thing missing or wrong,
10 = 100% correct.

Note: all partial credit must be justified with a comment. If you are really confused about how to grade a particular problem, you are given a limited number of "I don't know" skips that you can use on every assignment. You always get at least two, and more if the HW has lots of parts. This is not supposed to be a stressful process and the skips are there to let you not obsess about how to grade any one part.

Your self-grades will be due Thursday at noon after the homework deadline and if you don't properly enter any grades by the self-grading deadline, you are giving yourself a zero on that assignment. Just doing the homework is not enough, you have to do the homework, turn it in on time, read the solutions, do the self-grades, and turn them in on time. Unless all of these steps are done, **you get a zero for that assignment**. We will be dropping your lowest-scored homework from your final grade calculation, so getting a single zero on a HW is not the end of the world.

Just as we encourage you to use a study group for doing your homework, we strongly encourage you to have others help you in grading your assignments while you help grade theirs. This will also help you avoid self-favoritism.

The readers are going to be grading and sending you occasional comments. Because we have reader grades, we will catch any attempts at trying to inflate your own scores. This will be considered cheating and is definitely not worth the risk. Your own scores will be used in computing your final grade for the course, adjusted a bit by taking into account reader scores so that everyone is effectively fairly graded on the same scale. (E.g. If we notice that you statistically tend to shade 8s into 5s a bit much as compared to the readers looking at your homeworks, we will apply a correction to pull your scores up a bit.)

If you have any questions, please ask on Piazza.

Extra credit will be available for many creative activities including helping us debug issues with the class and coming up with constructive solutions. (For example: creating practice problems with solutions, providing patches to bugs in labs and homeworks, etc...) Talk with your GSI in person or post on Piazza if you want to get feedback from the entire class.

Course Communication

The instructors and TA will post announcements, clarifications, hints, etc. on Piazza (https://piazza.com/class/is6hf2wb49l6b4). Hence you must check the EE16B Piazza page frequently throughout the term. (You should already have access to the EE16B Fall 2016 forum. If you do not, please let us know.) If you have a question, your best option is to post a message there. The staff (instructors and TAs) will check the forum regularly, and if you use the forum, other students will be able to help you too. When using the forum, please avoid off-topic discussions, and please do not post answers to homework questions before the homework is due.

If your question is personal or not of interest to other students, you may mark your question as private on Piazza, so only the instructors will see it. If you wish to talk with one of us individually, you are welcome to come to our office hours. Please reserve email for the questions you can't get answered in office hours, in discussion sections, or through the forum.

It can be challenging for the instructors to gauge how smoothly the class is going. We always welcome any feedback on what we could be doing better. If you would like to send anonymous comments or criticisms, please feel free to use an anonymous remailer like this one (http://gilc.org/speech/anonymous/remailer.html) to avoid revealing your identity.

Collaboration

You are encouraged to work on homework problems in study groups of two to four people; however, you must **always** write up the solutions on your own. Similarly, you may use books or online resources to help solve homework problems, but you must always credit all such sources in your writeup and you must never copy material verbatim. We believe that most students can distinguish between helping other students and cheating. Explaining the meaning of a question, discussing a way of approaching a solution, or collaboratively exploring how to solve a problem within your group is an interaction that we strongly encourage. But you should write your