EECS16B | Designing Information Devices and Systems II

Fall 2019

Schedule

This schedule is tentative and subject to change.
(Please scroll horizontally if you're viewing this on your phone.)

Week	Date	Lecture Topic	Section	Lab
0	08/29 Th	16A Review (Webcast (https://www.youtube.com/watch?v=4ihMGPXviKI))	**No Section**	Syl
1	09/03 Tu	Computing: Transistors, Logic, and Differential Equations (Webcast (https://www.youtube.com/watch?v=Ugs1KxYhJMU)) (Note 1 (notes/note1.pdf))	**Section 1A** (Dis (discussion/dis1A.pdf)) (Ans (discussion/ans1A.pdf))	Lab (lab/Lab_S (Lab
	09/05 Th	Computing: Delays and Inputs (Webcast (https://www.youtube.com/watch?v=Tpg2DxEiWX8)) (Note (Inputs) (notes/note_input.pdf))	**Section 1B** (Dis (discussion/dis1B.pdf)) (Ans (discussion/ans1B.pdf))	
2	09/10 Tu	Filters: Multivariate Differential Equations (Webcast (https://www.youtube.com/watch?v=9-OaYTvGoYA)) (Note 2 (notes/note2.pdf))	**Section 2A** (Dis (discussion/dis2A.pdf)) (Ans (discussion/ans2A.pdf))	Lab (Lab
	09/12 Th	Filters: Coordinate Changes, Diagonalization, and the	**Section 2B** (Dis	

Week	Date	Lecture Topic	Section	Lab
	Th	Diagonalization, and the Eigenbasis (Webcast (https://www.youtube.com/watch?v=dwpQeB4TpZA))	(Dis (discussion/dis2B.pdf)) (Ans (discussion/ans2B.pdf))	
3	09/17 Tu	Filters: Inductors and Complex Eigenvalues (Webcast (https://www.youtube.com/watch?v=S5G7kwBYLVM)) (Note j (notes/notej.pdf))	**Section 3A** (Dis (discussion/dis3A.pdf)) (Ans (discussion/ans3A.pdf))	Lab (Lab
	09/19 Th	Filters: Complex Exponential Inputs and Phasors (Webcast (https://www.youtube.com/watch?v=2YLkRQNyDWQ)) (Note (Phasors) (notes/note_phasors.pdf))	**Section 3B** (Dis (discussion/dis3B.pdf)) (Ans (discussion/ans3B.pdf))	
4	09/24 Tu	Filters: Phasors and Transfer Functions (Webcast (https://www.youtube.com/watch?v=adkZrAY2ciQ)) (Note (Circuit Filters) (notes/note_circuit_filters.pdf))	**Section 4A** (Dis (discussion/dis4A.pdf)) (Ans (discussion/ans4A.pdf))	Lab 4 (Lab (lab/ P
	09/26 Th	Filters: Resonance (Webcast (https://www.youtube.com/watch?v=UKpCc50odkU))	**Section 4B** (Dis (discussion/dis4B.pdf)) (Ans (discussion/ans4B.pdf))	
5	10/01 Tu	Robotics: Control in discrete-time. Basic Concepts (Webcast (https://www.youtube.com/watch?v=nSbOJFUCl-k))	**Section 5A** (Dis (discussion/dis5A.pdf)) (Ans (discussion/ans5A.pdf))	Lab 5 (Lab
	10/03 Th	Robotics and Learning: System Identification (Webcast (https://www.youtube.com/watch?v=FBlZKU9CbjQ))	**Section 5B** (Dis (discussion/dis5B.pdf)) (Ans (discussion/ans5B.pdf))	
6	10/08 Tu	Robotics and Learning: Outlier Rejection	**No Section**	Project

Week	Date	Lecture Topic	Section	Lab
	Tu	Rejection (Webcast (https://www.youtube.com/watch?v=xtiw8sWFoEo))		(lab/Proje
	10/10 Th	Cancelled due to PG&E response to Wind	**No Section**	
7 **Midterm 10/15 9:30–11am**	10/15 Tu	In-Class Midterm 1	**Section 7A** (Dis (discussion/dis7A.pdf)) (Ans (discussion/ans7A.pdf))	Project I (lab/Project
	10/17 Th	Robotics: Finish outliers and orthonormalization, start stability (Webcast (https://www.youtube.com/watch?v=iNykNlwic3k))	**Section 7B** (Dis (discussion/dis7B.pdf)) (Ans (discussion/ans7B.pdf))	
8	10/22 Tu	Robotics: Stability (Webcast (https://www.youtube.com/watch?v=Q-KBiEKlDB8))	**Section 8A** (Dis (discussion/dis8A.pdf)) (Ans (discussion/ans8A.pdf))	Project P (lab/Project
	10/24 Th	Robotics: Stability and Feedback to Stabilize (Webcast (https://www.youtube.com/watch?v=tA87Xuqn2ls))	**Section 8B**	
9	10/29 Tu	Robotics and Learning: Planning and minimum-energy paths (Webcast (https://www.youtube.com/watch?v=B9ZPxx9ZSbM))	**Section 9A** (Dis (discussion/dis9A.pdf)) (Ans (discussion/ans9A.pdf))	Project
	10/31 Th	Learning: The SVD	**Section 9B** (Dis (discussion/dis9B.pdf)) (Ans (discussion/ans9B.pdf))	
10	11/05 Tu	Learning: PCA	**Section 10A**	Buffer Day

Week	Date	Lecture Topic	Section	Lab
	11/07 Th	Learning: Classification	**Section 10B**	
11 **Midterm 11/13 8–10pm**	11/12 Tu	Robotics: CCF for Stabilization	**Section 11A**	Buffer
	11/14 Th	Robotics and Learning: Linearization for nonlinear problems	**Section 11B**	
12	11/19 Tu	Learning: Interpolation	**Section 12A**	Project
	11/21 Th	Learning: Interpolation	**Section 12B**	
13	11/26 Tu	Learning: Interpolation	**Section 13A**	
	11/28 Th	Thanksgiving Break	**Section 13B**	
14	12/03 Tu	Wireless: basic modeling and OFDM	**Section 14A**	Project
	12/05 Th	Wireless and Learning: Tracking while communicating	**Section 14B**	
15		RRR Week		RRR We
16		Final Examinations		

Calendar

EECS16B Calendar

Please note the colors for discussion sections:

There is pink for freshmen,	orange for Math 54,	brown for transfers,	and red for general sections.

Resources

Piazza: (https://piazza.com/class/jzapntwvv074c9) ask questions here.
Homework Practice: (hw-practice/) practice homework questions.

Lab

- Syllabus (lab/Lab_Syllabus_Fa19.pdf)
- Lab tutorials (https://www.youtube.com/playlist?list=PLQ1OVCqw6RUMX2JzPw2G15s5mZovuav8-)
- Oscilloscope cheat sheet (student-resources/oscilloscope-cheatsheet.pdf)

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)
- Second Order Circuits (https://www.youtube.com/watch?v=rKBZBE9dw4A)
- Linearization (https://www.youtube.com/watch?v=Dy6LG_69iQ4)
- Observers and Observability (https://www.youtube.com/watch?v=Q1H-1Ciu554)
- Feedback Control (https://www.youtube.com/watch?v=hzFcDYodP7A)
- Singular Value Decomposition (https://www.youtube.com/watch?v=j0SJhVIfb5g)

Circuits

- Charge (student-resources/Charge.pdf)
- Current (student-resources/Current.pdf)
- Voltage (student-resources/Voltage.pdf)
- Kirchoff's Laws (student-resources/Kirchoff.pdf)
- Parallel and Series Resistors (student-resources/ResistorsInSeriesAndParallel.pdf)
- Voltage and Current Dividers (student-resources/VoltageAndCurrentDividers.pdf)
- Thevenin / Norton Equivalent Circuits and Source Transformation (student-resources/thevenin.pdf)
- Bode plot practice problems (student-resources/bode_plot_practice.zip)

DFT

- Interactive guide to the DFT (https://betterexplained.com/articles/an-interactive-guide-to-the-fourier-transform/)
- A New Sequence in Signals and Linear Systems's take on DFT (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)
- An article about SVD and its applications (http://www.ams.org/publicoutreach/feature-column/fcarc-svd)
- Image processing with the SVD (http://math.mit.edu/~gs/linearalgebra/linearalgebra5_7-1.pdf)
- Visualization of PCA (http://setosa.io/ev/principal-component-analysis/)
- Visualization of k-means (http://tech.nitoyon.com/en/blog/2013/11/07/k-means/)

Sampling and Aliasing

- JPEG transform compression (http://www.dspguide.com/ch27/6.htm)

Controls

- Murat Arcak's EECS16B reader (http://inst.eecs.berkeley.edu/~ee16b/sp18/note/16Breader.pdf)
- Murray and Astrom (http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page)
- Franklin, Powell, and Workman (https://www.amazon.com/Digital-Control-Dynamic-Systems-Edition/dp/0201820544)

Replacement MT score (on scale of 100) = max [MT score, final exam score - 15% (on scale of 100)] This essentially allows you to replace your midterm grade by a higher grade --- we want to reward improved performance.

If you complete the optional midterm redo for both midterms, and are eligible for a clobber on both midterms, the clobber that helps your score more is applied (i.e. you may clobber either Midterm 1 or Midterm 2, but not both, and only if you complete both midterm redos). Please note that even though lecture attendance is not included in the clobbering eligibility criteria, we do strongly encourage you to attend lecture in person.

Participation

Participation is worth a maximum of 25 points, and is measured by the quality of holistic engagement with the course: lecture, discussion, HW Party, Piazza, and any other activities that demonstrate positive engagement. More details will be given later in a Piazza post, but these are basically good engaged citizen points.

Homework Party

Homework parties are your chance to meet and interact with other students, while also having the chance to get help from GSIs and Faculty. This is your chance to have a social experience as part of the class. We expect students to treat each other with respect during homework parties as well as during all other parts of the class – including interactions on Piazza, discussion and office hours. Remember that each of you is coming into a class with different experiences and backgrounds – use this as an opportunity to learn from one another.

Homework Party will be held on Fridays from 2-5 PM at the Wozniak Lounge in Soda.

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. We highly encourage students to attend homework party.

Homework Submission

Homeworks are due on Monday night at 11:59 PM. You need to turn in a .pdf file consisting of your written-up solutions that also includes an attached pdf "printout" of your .ipynb code on Gradescope. **Any homework submissions that are turned in without the code “printout” (or screenshot) attached will receive a zero on the coded ipython notebook portions of the homework. Any problems without pages selected will receive zero credit.** If you have any questions about the format of a homework submission, please go to office hours or homework party.

You will have the opportunity to resubmit your homework after homework solutions are released to get makeup credit. See below for details.

Homework Grading - Self-Grading

The point of homework in this class is for you to learn the material. To help you in doing this each student will grade their own homework. After the HW deadline, official solutions will be posted online. You will then 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:

Score	Reason
0	Didn't attempt or very very wrong

Score	Reason
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: You must justify self-grades of 2, 5, or 8 with a comment. Grades of 0 and 10 do not need to be justified. If you are really confused about how to grade a particular problem, you should post on Piazza. This is not supposed to be a stressful process.

Your self-grades will be due on the Wednesday following the homework deadline at 11:59 PM sharp. We will accept late self-grades up to a week after the original homework deadline for 65% credit on the associated homework assignment. If you don't enter a proper grade by this deadline, you are giving yourself a zero on that assignment. Merely doing the homework is not enough, you must do the homework; turn it in on time; read the solutions; do the self-grade; and turn it in on time. **Unless all of these steps are done, you will get a zero for that assignment.**

We will automatically drop the lowest homework score from your final grade calculation. This drop is meant for emergencies. If you use this drop half-way into the semester, and request another, we cannot help you.

Just like 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.

If you have any questions, please ask on Piazza.

Homework Resbmission

Again, the point of homework in this class is to help you learn. We understand that sometimes work from other classes, midterms or your personal life can come in the way of making a homework deadline. For this reason we will allow you to resubmit your homework for 70% credit.

Homework resubmissions must be HANDWRITTEN. Homework resubmissions will be due along with the self-grades, so they will be due by 11:59pm Wednesday night. If you choose to resubmit your homework, you must submit two sets of self-grades, one for the first submission and one for the second submission. For the second submission do self-grades as normal. We will apply the 70% correction.

You need to turn in a .pdf file consisting of your written-up solutions that also includes an attached pdf "printout" of your .ipynb code on Gradescope. **Any homework submissions that are turned in without the code "printout" (or screenshot) attached will receive a zero on the coded ipython notebook portions of the homework. Any problems without pages selected will receive zero credit.** If you have any questions about the format of a homework submission, please go to office hours or homework party.

What does 70% credit mean? Let us say you only were able to get half-way through a problem during the first submission. You submitted your homework on Monday, and while going through the solutions you understood how to do the whole problem. Your self-grade for your first

submission would be a 5/10. However, you can resubmit the homework problem with a fully correct solution and receive 70% of the remaining points as extra points, i.e. (10-5) * 70/100 = 3.5 extra points, and so your score for the problem would go from 5 points to 8.5 points.

Homework Effort Policy

Because the point of homework in this class is to help you learn, not to punish you for making small mistakes, if your final score (after resubmission and any other corrections are applied) on any homework is above 8/10, your grade on that HW will automatically be bumped up to 100% (10/10).

Lab and Discussion Section Policies

Check out updated lab policies here: Lab Syllabus (Lab_Syllabus_Fa19.pdf). This same information is also present at the top of the schedule table on this site.

Additionally, note that while discussion (like lecture) is a mandatory part of the course, we will not be taking attendance in either discussion or lecture. However, such attendance can help contribute to the participation portion of your grade. For more information, check this Piazza post (https://piazza.com/class/jzapntwvv074c9?cid=318).

Exam Policies

There are two midterms and one final. The midterms will be Thursday, October 10th, 2019 from 7pm to 9pm and Wednesday, November 13th, 2019 from 8pm to 10pm. The final will be held on Tuesday, December 17th, from 3pm to 6pm. Makeup exams will not be scheduled.

Please plan for exams at these times. In case of an emergency on exam day, please email the head TAs as soon as possible and provide details of the issue as well as a contact phone number. Emergency exam conflicts will be handled on a case-by-case basis. Exam conflicts originating from a lecture conflict will not be accommodated.

On exam day, you must bring your Cal student ID to your exam location. Locations and logistics will be posted on Piazza closer to the exam dates. If you do not take your exam in the correct location, a large penalty will be applied to your exam score. Additionally, regrade requests on Gradescope are typically due within a week of exams being released on Gradescope. Late regrade requests will not be considered. If a regrade request is submitted for a part of a question on the exam, the grader reserves the right to regrade the entire exam and could potentially take points off.

Exceptions

Any requests for exceptions should be emailed to the head TAs.

Email the exception request out as soon as possible. Exceptions will be handled on a case-by-case basis. Since there is one homework drop, missing homework is rarely excused. Examples of situations that merit an exception are medical emergencies and family emergencies. It will be easier for us to grant an exception if you have a doctor's note or other documentation.

Course Communication

The instructors and TAs will post announcements, clarifications, hints, etc. on Piazza. Hence you must check the EECS16B Piazza page frequently throughout the term. (You should already have access to the EECS16B Fall 2019 forum. If you do not, please let us know.)

If you have a question, your best option is to post a message on Piazza. 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. Also, always look for a convenient category to post the question to (for example, each homework will have its own category, so please post there). That will ensure you get the answer faster.

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.

For any exceptions that are of a personal nature, please contact the head TAs. Technical and homework questions are best resolved in homework and during office hours.

Collaboration

We encourage you 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 write up, and you must never copy material verbatim. **Using previous EECS16B homework, exam, and lab solutions is strictly prohibited, and will be considered academic dishonesty. This is not how you want to start your career as an engineer.**

We expect 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 encourage strongly. But you should write your homework solution strictly by yourself so that your hands and eyes can help you internalize the subject matter. You should acknowledge everyone whom you have worked with, or who has given you any significant ideas about the homework. This is good scholarly conduct.

Don't Be Afraid to Ask For Help

Are you struggling? Please come talk with us! The earlier we learn about your struggles, the more likely it is that we can help you. Waiting until right before an exam or the last few weeks of the semester to let us know about your problems is not an effective strategy - the later it is, the less we will be able to help you.

Even if you are convinced that you are the only person in the class who is struggling, please overcome any feelings of embarrassment or guilt, and come ask for help as soon as you need it – we can almost guarantee you're not the only person who feels this way. Don't hesitate to ask us for help – we really do care that you thrive! You can email the head TAs, or email / talk to any TA at any time -- we're happy to help.

Advice

The following tips are offered based on our experience.

Do the homeworks! The homeworks are explicitly designed to help you to learn the material as you go along. There is usually a strong correlation between homework scores and final grades in the class.

Keep up with lectures! Discussion sections, labs and homeworks all touch on portions of what we discuss in lecture. Students do much better if they stay on track with the course. That will also help you keep the pace with your homework and study group.

Take part in discussion sections! Discussion sections are not auxiliary lectures. They are an opportunity for interactive learning. The success of a discussion section depends largely on the willingness of students to participate actively in it. As with office hours, the better prepared you are for the discussion, the more you are likely to benefit from it.

Please come to office hours! We love to talk to you and do a deep dive to help you understand the material better.

Form study groups! As stated above, you are encouraged to form small groups (two to four people) to work together on homeworks and on understanding the class material on a regular basis. In addition to being fun, this can save you a lot of time by generating ideas quickly and preventing you from getting hung up on some point or other. Of course, it is your responsibility to ensure that you contribute actively to the group; passive listening will likely not help you much. And recall the caveat above that you must write up your solutions on your own. We advise you strongly to spend some time on your own thinking about each problem before you meet with your study partners; this way, you will be in a position to compare ideas with your partners, and it will get you in practice for the exams. Make sure you work through all problems yourself, and that your final write-up is your own. Some groups try to split up the problems ("you do Problem 1, I'll do Problem 2, then we'll swap notes"); not only is this a punishable violation of our collaboration policies, it also ensures you will learn a lot less from this course.