

Syllabus

Instructors:

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Lecture: Tue, Thur 3:30-4:45pm ESB 1003
Lab Group 1: Wed 7-9:50pm Harold Frank Hall 3120a
Lab Group 2: Fri 10-12:50am Harold Frank Hall 3120a

Website: http://www.ece.ucsb.edu/courses/ECE147/147B_W13Byl/index.html

Required Text:

Either of the two books listed below can be used for ECE 147B this quarter.

1. (FPW) Franklin, Powell, and Workman, "Digital Control of Dynamic Systems, 3rd edition".
See website for information on purchasing a discounted reprint of the book.
2. (FV) Fadali and Visioli, "Digital Control Engineering, 2nd edition".

Grading: Homework (25%), Lab (25%), Mid-Term (20%), Final (30%).

- **Homework (including Computer Modules):** There will be 8 homework assignments. Only the best 7 out of 8 of these assignments will count toward your term grade.
- **Laboratories:** Lab Group times listed above are tentative and may change during the first week of class, depending on student and TA scheduling conflicts. (The Wednesday section will remain, but Friday appears to be an unpopular time – as usual.) You must contact the instructors if you need to switch lab groups. Lab begins the first week of class with an (optional) introductory mini-session ("Lab 0") for which no write-up is due. (*Those who have taken ECE147A may find "Lab 0" unnecessary... It is intended to provide familiarity the basics of the Quanser controls lab set-ups.*) See the link to the lab website for future pre-lab assignments and post-lab reports.
- **Mid-Term Exam:** The mid-term is *tentatively* scheduled for Tuesday, February 12 during lecture (3:30-4:45pm in ESB 1003) and will cover material (in lecture and/or lab) from the first 5 weeks of class (i.e., through February 8). You are allowed one (1) single-sided 8½ x 11 sheet of notes for the mid-term exam. Your "cheat sheet" must be self-prepared and will also be submitted with your exam; it will then be returned (unmarked) along with your graded exam.
- **Final Exam:** A 3-hour final exam will cover class material (from lecture and lab) from all 10 weeks of class. Time (Thursday, March 21, 4-7pm) and location (ESB 1003) are determined by the registrar. You are allowed two (2) single-sided 8½ x 11 self-prepared sheets of notes for the final exam. Both of these "cheat sheets" will also be submitted with your exam; they will then be returned (unmarked) along with your graded exam.

Tentative Lecture Schedule

Our exact schedule may be revised somewhat throughout the term. (FPW refers to Franklin, Powel and Workman. RS refers to Roy Smith's lecture notes for ECE 147b, available on website. FV refers to the Fadali and Visioli text. Either (not both) FPW or FV is sufficient!

Week	Day	Topics	Reading
1	1/8 1/10	1. Review of CT dynamics and control. Bode and Nyquist. 2. Difference equations. Sampling. Tustin (bilinear) approx.	FPW (Ch.1), 2.1-2.5; RS-1,2; FV 2.1, 5.1-5.3 FPW 3.1-3.2, 4.1; RS-3; FV 2.2, 3.1-3.2, 6.3.1, 6.3.2
2	1/15 1/17	3. Tustin w/pre-warp. Discrete-time (DT) trans fns (TFs). 4. Sampled-data systems. ZOH. Properties of z-transform.	FPW 4.2, 6.1 (pp.189-195); RS-4; FV 3.3-3.7 FPW 4.3.1, 4.6; RS-5; FV 2.3, 2.5
3	1/22 1/24	5. Time response. S-plane vs Z-plane. Sampling. 6. Freq. response. Direct control design: deadbeat control.	FPW 4.4, 7.3.1; [RS-3], RS-6; FV 2.6 FPW 4.5, 7.5; RS-7; FV 2.8, 4.1-4.6, 6.7
4	1/29 1/31	7. Intro to state space (SS). 8. State space, continued.	FPW 4.3.3; RS-8; FV 7.1, 7.2 FPW 6.1 (pp.197-200); RS-9; FV 7.6, 7.7
5	2/5 2/7	9. Discrete equivalents to CT SS. ZOH in SS. 10. Review for midterm.	FPW 6.1 (pp.197-200); RS-10; FV 7.8, 7.9 <i>Review material through Feb.7.</i>
6	2/12 2/14	** Midterm [material through week 5] ** 11. Controller design: emulation vs pole placement.	1 single-sided sheet of notes FPW 7.2, 8.1; RS-11; FV 6.5, (9.1), 9.2
7	2/19 2/21	12. Estimator design via pole placement. 13. Reduced-order estimator. Separation principle.	FPW 8.2.1-8.2.4; RS-12; FV 9.5.1 FPW 8.2.5, 8.3; RS-13; FV 9.5.2, 9.6
8	2/26 2/28	14. Frequency response methods. 15. Reference tracking.	FPW 7.4; FV (6.4), 6.5, (6.6) FPW 8.4.1; RS-14; FV 9.3, 10.4.3
9	3/5 3/7	16. Integral control via state augmentation. 17. Intro to LQR. Least-squares estimation.	FPW 8.5.1; RS-15; FV p. 370 FPW 9.3.5, 9.4.1; RS-16; FV 10.2-10.4
10	3/12 3/14	18. Recursive least-squares. Kalman filtering. 19. Review for final.	FPW 9.4.1-9.4.2 (pp.387-394); FV (10.1.1) <i>Review all material to date.</i>

Due dates. The tentative schedule for due dates below is only a general guideline. *There may be some variation during the course of the term.*

- **Homework:** Due by **FRIDAY at 5:00pm**. There will be 8 assigned homeworks, but only your top 7 scores will be counted. (No HW is due Week 1 or Week 6 (midterm week).)
- **Pre-lab:** Due on **MONDAY at noon**, in the drop box outside HFH 3120. There are 7 required pre-labs (no pre-lab for weeks 1, 6, or 10.), and 1 extra credit pre-lab.
- **Lab reports:** Due in Lab, **the next time your group meets after a lab is performed**. (Usually, this means one week later, except for midterm week.)

Lecture Videos: Video of lectures from last year is available via a link on the "Lectures" page of the course website.