ECE317: Feedback and Control

(Fall 2025)

Instructor: R. Tymerski, FAB 160-18.

Class: FAB 150, T and Th 7:20-9:00 pm
Office Hours: FAB 160-18, T and Th 6:20-7:20 pm
Grader:: TBD (There is no TA for this course this term).

Course Learning Objectives:

1) To apply classical control principles to the design of continuous time control systems, and
2) To obtain proficiency with software (Matlab/Simulink and QSpice/PECS) that aids in the design and simulation process.

References:

Applied Classical and Modern Control System Design, by R. Tymerski and F. Rytkonen. Provided on course web site.

Important: The 5 Labs will be made progressively available on the course webpage as the term progresses. All labs will involve use of the QSpice simulator. There is no hardware construction required. The QSpice simulator can be downloaded, free of charge, from https://www.qorvo.com/design-hub/design-tools/interactive/qspice .

Grading system:

• Midterm:	Week 6, November 6	20%
• Final exam:	Week 11, December 11, 5:45-7:35 pm	50%
• Lab	5 Labs, see schedule below for due date deadlines	30%

To pass the class you need a score of at least 50% on the Final exam.
No make-up exams will be given, except for medical reasons for which documentation will need to be provided. All exams are comprehensive.

A guideline for the grading scale is:

A → 90 − 100 pts
B → 80 − 89 pts
C → 70 − 79 pts
D→ 60 − 69 pts
F → < 60 pts

Instructor discretion may be applied to the boundaries between letter grades.

Content: This course introduces classical control theory for the feedback design of continuous time SISO (single-input, single-output) systems.

Syllabus:

Topics covered:

1. Review:
    i. Laplace transform
    ii. Transfer function
2. Block Diagrams
    i. Transfer function representation as a block diagram
    ii. Block diagram analysis
3. Feedback overview
    i. Benefits
    ii. Simple design example
    iii. Sensitivity
4. System Response
    i. Response of first-order systems
    ii. Response of second-order systems
        a. Undamped natural frequency and damping ratio
        b. Overshoot, rise time and settling time
5. Stability Analysis
    i. Pole location requirement
    ii. Routh-Hurwitz test
6. Steady State Error
    i. Unity gain systems
    ii. Non-unity gain systems
7. Frequency Response
    i. Steady state system analysis for sinusoidal inputs
    ii. Magnitude and phase response – Bode plots
    iii. Closed loop stability using Bode plots, phase and gain margins
    iv. Straight line asymptote Bode plot construction
    v. Matlab functions: bode, margin, unwrap, etc.
8. Practical Example Feedback System Design – Buck dc-to-dc converter
    i. Identification and verification of salient transfer functions of the system
    ii. Introduction to describing function modelling
    iii. Design of controllers using Bode plots
    iv. Performance comparison between various controller designs

Lab and Exam Schedule

	Tuesday	Thursday
Week 1:	**9/29: Start Lab 1**	**10/2:**
Week 2:	**10/7:**	**10/9:**
Week 3:	**10/14: Start Lab 3, Lab 1 due**	**10/16:**
Week 4:	**10/21: Start Lab 4**	**10/23:**
Week 5:	**10/28: Start Lab 5, Lab 3 due**	**10/30:**
Week 6:	**11/4: Lab 4 due**	**11/6: Midterm exam**
Week 7:	**11/11: Holiday**	**11/13:**
Week 8	**11/18: Lab 5 due, Start Lab 6**	**11/20:**
Week 9	**11/25:**	**11/27: Holiday**
Week 10	**12/2:**	**12/4: Lab 6 due**
Week 11 (Finals week)	**12/9:**	**12/11 Thursday: Final Exam, 5:45-7:35pm**

Final exam schedule: https://www.pdx.edu/registration/final-exam-schedule

Labs:

- There are 5 labs which comprise a total score of 30% towards the final grade.
- Labs will be done in groups. We'll establish the groups soon after the term starts. Once established the groups will remain immutable for the remainder of the term.
- Place the names of the people in your group who contributed to the lab report on the front page of your report. Missing names from your group will not be credited for that specific lab.

Lab Report Policy:

- Lab reports have hand-in deadlines. **Hard copy reports** should be submitted by the *start* of class on the due date. Doing otherwise the report will be seen as late and may receive a substantial points penalty (at best) or not be accepted.
- See 'Lab Report Guidelines' document to see the expectation concerning the presentation of reports.

Policy on plagiarism

- Groups found copying or sharing work will be given a grade of 0 for the lab.
- All members in the group share responsibility in ensuring that submitted material has not been plagiarized.
- In short …

- Don’t copy and paste others’ sentences, figures, photos etc, without getting permission and without referring to the original.
- Form your own prose in writing reports.
- Draw figures and take screenshots/photos yourself.

Notes:

1) There are no extra credit assignments of any kind.
2) On occasion the instructor may need to communicate with the whole class or specific members of the class via the email address the student specified during registration. It is the student’s responsibility to keep this address updated.
3) Any form of cheating on the quizzes or the final exam will not be tolerated. If you cheat on an exam, you get a score of zero on that exam. This is viewed very seriously. Your case will be referred to the PSU Office of the Dean of Student Life for adjudication.
4) Accommodations are collaborative efforts between students, faculty, and the Disability Resource Center. Students with accommodations approved through the DRC are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through the DRC should contact the DRC immediately.
5) If you are already registered with DRC for this class see me ASAP.
6) The contents of this syllabus are subject to change. Any changes will be announced in class.