

ECE 451 – Systems Dynamics & Control

Catalog Description: Modeling and analysis of linear continuous systems in time and frequency domains. Fundamentals of single-input-single-output control system design.

Credits: 4 **Terms Offered:** Fall, Winter

Prerequisites: (ENGR 212, ECE 351, ECE 352) or ME 317

Courses that require this as a prerequisite: ME 414, ME 514

Structure: Two 110-minute lectures per week

Instructors: J. Schmitt (primary), K. Tumer (secondary)

Course Content:

- Laplace transforms review
- Equations of motion
- State space form of equations of motion and numerical integration
- Block diagrams
- Time response of dominantly 1st order systems; time response of dominantly 2nd order systems
- System stability
- Simulation of control systems
- Basic control system concepts
- Root locus design
- Pole placement design
- Bode analysis
- Lead/lag compensation design
- Nyquist analysis

Measurable Student Learning Outcomes:

At the completion of the course, students will be able to...

1. **Construct** a mathematical model of a dynamic system that includes a control system (ABET Outcomes: a, e, m, n)
2. **Simplify** mathematical models to linear, time-invariant systems through linearization and block diagram reduction (ABET Outcomes: a, e, m, n)
3. **Use** time-domain performance criteria to **design** single-input, single-output control systems that achieve specified time-response, accuracy and stability requirements (ABET Outcomes: a, c, e, m, n)
4. **Construct and use** frequency response tools to design single-input, single-output control systems that achieve specified time response and stability requirements (ABET Outcomes a, c, e, m, n)
5. **Use Matlab to design, simulate, and analyze** the response of controlled dynamic systems. (ABET Outcomes: k)

Learning Resources:

- Norman S. Nise, *Control Systems Engineering*, 4th edition, John Wiley and Sons Inc., United States, 2004
- The companion website to the book (<http://www.justask4u.com/csp/nise/EFramesetLogin.csp>) provides interactive solutions of select end of chapter problems along with review material that highlights the key concepts of the chapter
- The course website (<http://classes.engr.oregonstate.edu/me/winter2007/me430/index.html>) provides additional resources, including homework sets and solutions, supplemental solved example problems etc.

Students with Disabilities:

Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD 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 SSD should contact SSD immediately at 737-4098.

Link to Statement of Expectations for Student Conduct:

<http://oregonstate.edu/admin/stucon/achon.htm>

Revised: 5/24/07