

# EECE 5580

## Classical Control Systems

4 Credits · Graduate & Senior Undergraduate

**Build a self-balancing robot. Apply control theory. Compete.**

### Theory

- Transfer functions
- State-space models
- Stability analysis
- Root locus & Bode
- Lead/lag compensation
- LQR state feedback

### Hardware

- Robot chassis build
- DC motors & H-bridge
- IMU + encoder wiring
- Microcontroller (200 Hz)
- Real-time data logging
- Hardware debugging

### Competition

- PID & LQR tuning
- Disturbance rejection
- MATLAB/Simulink
- Team design sprints
- Balancing challenge
- Department showcase

#### SEMESTER ROADMAP

Wk 1–4 <b>Foundations</b> Laplace · state-space	Wk 5–7 <b>Hardware Lab I</b> Robot build & wiring	Wk 8–10 <b>Stability &amp; Design</b> Root locus · Bode	Wk 11–13 <b>Hardware Lab II</b> PID & LQR on robot	Wk 14–16 <b>Compete!</b> Live challenges
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#### WHAT YOU WILL DO

- Derive equations of motion for an inverted pendulum
- Design PID, lead/lag, and LQR controllers in MATLAB
- Wire motors, IMU, and encoders on a real robot chassis
- Deploy a 200 Hz control loop on a microcontroller
- Tune gains until your robot balances on its own
- Enter the end-of-semester balancing competition

### End-of-Semester Competition

Teams compete in a live balancing challenge judged on stability, disturbance rejection, and step-response speed.

Categories: Best Balance · Best Recovery · Best Technical Report · Fan Favorite

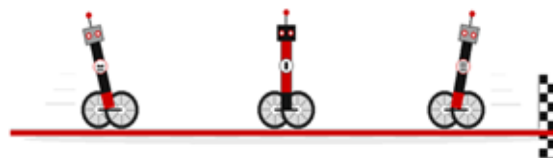
Deliverables: Lab notebooks · Design report · 30-min oral defense

#### Prerequisites

EECE 3464 or EECE 2520 · or Graduate Admission

#### Contact

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Course Website

