- Course number

  ECE666

- Course name

  Control Systems II

- Prerequisite

  ECE660

- Course description

1. Introduction
   - Classifications of nonlinear control problems
   - Observer-based design: extended separation principle.
   - Examples.
2. Trajectories of Second Order Systems
   - Linear Systems: Nodes, foci, saddle points, centers.
   - Nonlinear: Limit cycles
   - Higher order systems; chaotic behavior
3. Lyapunov's Theory of Stability
   - Definitions of stability and asymptotic stability.
   - Local stability: Lyapunov's First Method
   - Large-scale (global) stability: Lyapunov's Second Method
   - Basic theorems of Lyapunov's Second Method
   - Some applications in control systems
4 . Full-state feedback algorithms for unbouned control
   - Linearization about reference state.
   - Extended linearization: state-dependent Riccati equation (SDRE) method.
   - Feedback linearization
   - Other methods
5. Full-state feedback algorithms for bounded control.
   - Introduction: sets of reachable points for unstable plants.
   - Optimal control (time optimal and related)
   - Linear and nonlinear switching control
   - Pulse width and pulse frequency control.
6. Observers
   - Extended Kalman Filter
   - Extended linearization filter
   - Discrete-time observers.
   - Observers with all kinds of data.

Parameter estimation and related observers

- Course learning outcomes

    - Student will be proficient in designing feedback control algorithms for nonlinear dynamic processes.
    - Student will be proficient in use of Matlab's Control System Toolbox and Symbolic Toolbox
    - Student will be proficient in use of Matlab /Simulink to simulate closed-loop control systems

- Textbook and/or other resources

        - B. Friedland, *Advanced Control System Design*, Prentice-Hall, 1996
        - Matlab

- Course calendar

    Lectures: Weekly, September 12 – December 7

    Final Exam: December 14

    Project due: December 14

- Grading Schema

        - Final Exam: 40%
        - Homework: 40%
        - Project: 20%

- Academic Integrity policy

    University policy will be observed.