COURSE: EECS 460.**TITLE:** Control Systems Analysis and Design. **PREREQUISITES:** EECS 306 or Graduate standing. **ELECTIVE.**

TEXTBOOK: J. Kuo and Golnaraghi, *Automatic Control Systems*, 8th ed., Wiley

CATALOG DESCRIPTION: Basic techniques for analysis and design of controllers applicable in any industry (e.g. automotive, aerospace, computer, communication, chemical, bioengineering, power, etc.) are discussed. Both time- and frequency-domain methods are covered. Root locus, Nyquist and Bode plot-based techniques are outlined. Computer-based experiment and discussion sessions are included in the course.

COURSE OBJECTIVES:

1. To teach students basic concepts of steady-state and transient analysis of linear feedback systems;
2. To teach students basic concepts of robustness of linear feedback systems;
3. To teach students techniques and CAD tools for designing linear feedback control systems;
4. To stimulate student interest in control applications, & to prepare them for industry & graduate study

COURSE OUTCOMES [Program Outcomes Addressed]

1. Ability to design a controller so that a feedback systems meets steady-state and transient specs; [1,3,11]
2. Ability to design a controller so that a feedback systems meets robustness specs; [1,3,11]
3. Ability to recognize feedback problems that are fundamentally difficult; [1,3,11]
4. Ability to use root locus, Nyquist and Bode techniques to modify properties of a control system; [1,11]
5. Ability to identify and evaluate design tradeoffs among specs such as rise time and robustness; [1,5,11]
6. Ability to use CAD tools (Matlab) for analysis and design of control systems. [1,3,5,11,13,14]

TOPICS COVERED:

1. Transfer functions, Mason gain
2. Steady state response: tracking
3. Transient response: rise time, overshoot, stability (Routh table)
4. Root locus; use PID & lead-lag
5. Nyquist plot; closed-loop stable
6. Bode plots; Bode compensation
7. Time delays, non-minimum phase zeros, two degree of freedom designs

ASSESSMENT (Course outcomes)

1. Weekly HW sets [1,2,3,4,5,6]
2. 3 in-class exams [1,2,3,4,5,6]
3. 2 software-based projects

PROGRAM OUTCOMES ADDRESSED: 1,3,5,11
PROFESSIONAL COMPONENT ADDRESSED: 13,14
PREPARED BY: Andrew E. Yagle on Nov. 25, 2004

CLASS/LABORATORY SCHEDULE:
LECTURES: 3 per week @ 50 minutes.

COURSE DESCRIPTION: University of Michigan, College of Engineering, ELECTRICAL ENGINEERING PROGRAM