ABET Course Syllabus

1. Course number and name
   ECE431—Introduction to feedback control systems
2. Credits and contact hours
   3 credits, 3 contact hours

3. Instructor's name
   Bernard Friedland

4. Text material

   B. Friedland, Lecture Notes for ECE431. Distributed via Highlander Pipeline

   N.S.Nise, ``Control Systems Engineering" John Wiley., Recommended, but not required.

   K.J. Astrom, and R.M. Murray, Feedback Systems:An Introduction for Scientists and Engineers. Princeton Univ. Press. (Free PDF copy is available at course website; casebound copy from Amazon at about \$30.) Recommended, but not required.

   B. Friedland, Control System Design: An Introduction to State-Space Methods, Dover, (Under \$20 at Amazon) May be useful in ECE432 and graduate courses. ISBN-10: 0486442780 | ISBN-13: 978-0486442785

5. Specific course information

   a. brief description of the content of the course (Catalog Description)

   Introduction to feedback control systems. Examples of feedback control, block diagrams, analytical techniques (Laplace transform, state space methods), stability evaluation (Routh-Hurwitz criteria, root-locus, Nyquist plot, Bode plot) Performance evaluation (criteria, evaluation methods). Design project. Matlab/Simulink used extensively.

   b. prerequisites or co-requisites
      ECE 232
   c. indicate whether a required, elective, or selected elective
      Required course in Control Systems Track

6. Specific goals for the course
    a. specific outcomes of instruction,

1. **Ability to determine stability of a single-loop feedback control system analytically and with the aid of the Matlab Control System Toolbox.**

2. Ability to evaluate the performance of a single-loop feedback control system using the Matlab Control System Toolbox and Matlab's Simulink Toolbox.

3. Ability to design a PI control algorithm and evaluate performance

4. Perform a "paper" design of a simple control system and present a written and oral report of the result.

    b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Outcomes	**Satisfies Criterion 3 item**:
1.Stability determination	a, b, e, k
2.Performance evaluation	a, b, e, k
3.Design control algorithm	a, b, c, e, k
4. System design	a, b c, e, g, k

7. Brief list of topics to be covered

1. Introduction [1/2 wk]

2. Review of Laplace transform [1/2 wk]
Basic properties Transfer functions, Block diagrams

3. State-space methods [3 weeks]
Vector-matrix representation of differential equations, Transition matrix and resolvent, Transfer functions, Matlab tools

4. Stability [2 weeks]
Definitions,Linear systems, Routh-Hurwitz algorithms

5. Graphical stability algorithms [3 weeks]
Root-locus method, Nyquist plot, Bode plot, Stability margins, Nichols chart

6. Performance [1 week]
Steady state; system type, Transient; dominant pole concept

7. Introduction to design [2 weeks]
PID, State-variable feedback, total transfer function synthesis

8. Projects [2 weeks]