1. Catalog Description – (3 credits) Theory and design of linear control systems

2. Pre-requisites – EEL 3112 and EEL 3135

3. Course Objectives - To understand the essentials of mathematical system modeling; to be able to assess stability and performance properties of linear systems, and be able to design lead and lag controllers for linear systems using s-domain and frequency domain techniques.

4. Contribution of course to meeting the professional component (ABET only – undergraduate courses) - 3 credits of Engineering Science

5. Relationship of course to program outcomes: Skills student will develop in this course (ABET only undergraduate courses) - EE2, EE3, a, c, e, k

6. Instructor – Dr. Haniph Latchman
   a. Office location: 463 NEB
   b. Telephone: 392-4950
   c. E-mail address: latchman@list.ufl.edu
   d. Class Web site: www.list.ufl.edu
   e. Office hours: T 3rd, R 3rd

7. Teaching Assistant - None
   a. Office location:
   b. Telephone:
   c. E-mail address:
   d. Office hours:

8. Meeting Times – T 4th, R 4th-5th

9. Class/laboratory schedule - 3 class periods consisting of 50 minutes each

10. Meeting Location – 330 Larsen

11. Material and Supply Fees - None

12. Textbooks and Software Required -
   a. Title: Linear Control Systems - A First Course
   b. Author: Haniph A. Latchman
   c. Publication date and edition: 1999, John Wiley
   d. ISBN number: 0471-38783-5

13. Recommended Reading – Class notes
   a. Title:
Course Outline (provide topics covered by week or by class period) –

1.0 Introduction and Background
   1.1 Open-loop Vs Closed-loop Control Systems
   1.2 Control Objectives
   1.3 Mathematical Representation of Systems
   1.4 System Classification
   1.5 Control Strategies
   1.6 History of Control Theory and Control Systems

2.0 Linear Systems Theory and Classical Control
   2.1 Introduction
   2.2 A Motivational Example - Automotive Cruise Control
   2.3 The Laplace transform
   2.4 A State-space Approach
   2.5 A Direct Transfer Function Approach
   2.6 Transfer Function Model Standardization and Simplification
   2.7 Block Diagram Reduction
   2.8 Signal Flow Diagram and Mason's Rule
   2.9 Relationship Between Transfer Function and State-space Models

3.0 s-Domain Analysis and Performance Criteria
   3.1 Stability Definitions and Conditions
   3.2 Negative Feedback Analysis and Stability Testing
   3.3 Transient Time Response: The Effect of Pole Locations
   3.4 Second Order Time Response Characteristics
   3.5 Steady State Response and System Type

4.0 Classical s-domain Design Methods
   4.1 Constant Gain Controllers
   4.2 The Root Locus
   4.3 An Example
   4.4 1st Order Lag Controllers
   4.5 1st Order Lead Controllers
   4.6 PID Controllers

5.0 Frequency Domain Analysis and Performance Criteria
   5.1 The Nyquist Stability
   5.2 Gain and Phase Margins
   5.3 Performance Specifications in the Frequency Domain
   5.4 Robustness and Robustness Margins
   5.5 The Critical Direction

6.0 Frequency Domain Design Methods
   6.1 1st Order Lag Design
   6.2 1st Order Lead Design
   6.3 PID Controller Design in the Frequency Domain
   6.4 Introduction to H-infinity Design
7.0 State Variable Analysis and Design Methods
   7.1 Observability Controllability and Minimality
   7.2 Stability Criteria
   7.3 State Feedback and Output Feedback
   7.4 State Observers
   7.5 Optimal L2 Control

15. Attendance and Expectations - Class attendance is not required but all students are responsible for all material and information disseminated during class sessions as such information may not be posted on websites or otherwise.

Homework and other assignments will be given periodically and will be due within the first 5 minutes of class on the designated due-date. Use regular-size paper, staple the sheets together, fold and put your name and homework number at the top. Late homework will be accepted only in exceptional circumstances which need to be discussed with the Instructor for approval. Homework assignments will not be given over the phone. Graded homework will be returned in class or during office hours.

Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

16. Grading – Midterm test: 35%, Final exam: 45%. Assignments: 20%

The midterm test and the final examination will be given in class and dates for these will be announced in class. The final examination will be comprehensive, but with emphasis on material covered since the midterm exam. All tests and examinations will be closed book but students will be allowed one sheet of letter-sized paper written (in their own original handwriting) on one side for the midterm test and on both sides for the final examination.

17. Grading Scale – The grading scale is subject to possible curve based on relative class performance. Grades will be assigned dependent on absolute and relative class performance generally according to the following:

   90-100    A
   85.9-89.9  A-
   81.8-85.8  B+
   77.7-81.7  B
   73.6-77.6  B-
   68.5-72.5  C+
   64.4-68.4  C
   60.3-64.3  C-
   56.2-60.2  D+
   52.1-56.1  D
   48.0-52.0  D-
“A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

18. Make-up Exam Policy – If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed. For information on UF policies concerning attendance, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx#absences

19. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
   · UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
   · Career Resource Center, Reitz Union, 392-1601, career and job search services.

22. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.